CHAPTER V.—GENERATING EQUIPMENT.

Dynamos of central stations and electric railways.—It is significant for the purposes of this census to note the changes which have taken place during the past 10 years in the generating equipment of both central stations and electric railways. Since these two industries, aside from the isolated electric plants earlier referred to, report practically all the electric generating equipment of the country, the figures presented in Table 40 show with a high degree of accuracy the development of the electrical industries in the United States. There is, it may be observed, a closer connection between the kilowatt capacity of dynamos and the actual services rendered to the public than is the case with primary power equipment, for the latter, particularly in connection with the very large stations of which water-power plants are typical, may be used for purposes other than the generation of electric energy, such as the supplying of mechanical power to near-by concerns or the furnishing of steam used for heating purposes.

Table 40 CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—NUMBER, KIND, AND KILOWATT CAPACITY OF DYNAMOS: 1917, 1912, AND 1907.

	Number of stations having generating equipment.	Total.		Kind of dynamos.					
				Direct current, constant voltage.		Direct current, constant amperage.		Alternating and polyphase current.	
		Number.	Kilowatt capacity.	Number.	Kilowatt capacity.	Number.	Kilowatt capacity.	Number.	Kilowatt capacity.
Total:									
1917	5,590	15,508	11,919,186	4,160	944,970	325	23,753	11,023	10,950,463
1912	5,197	15,401	7,670,755	4,968	1,161,213	820	82,152	9,613	6,427,390
1907	5,056	15,297	4,432,641	5,872	1,347,962	1,685	80,992	7,740	3,003,687
Central stations:									
1917	5,243	13,428	8,994,407	3,195	418,571	308	18,116	9,925	8,557,720
1912	4,714	12,610	5,165,439	3,407	432,412	745	43,828	8,458	4,689,199
1907	4,487	12,173	2,709,225	3,680	406,460	1,685	80,992	6,808	2,221,773
Electric railways:									
1917	347	2,080	2,924,779	965	526,399	17	5,637	1,098	2,392,743
1912	483	2,791	2,505,316	1,561	728,801	75	38,324	1,155	1,738,191
1907	569	3,124	1,723,416	2,192	941,502	(1)	(1)	932	781,914
	PER CENT OF INCREASE.[2]								
Total:									
1907–1917	10.6	1.4	168.9	−29.2	−29.9	−80.7	−70.7	42.4	264.6
1912–1917	7.6	0.7	55.4	−16.3	−18.6	−60.4	−71.1	14.7	70.4
1907–1912	2.8	0.7	73.1	−15.4	−13.9	−51.3	1.4	24.2	114.0
Central stations:									
1907–1917	16.8	10.3	232.0	−13.2	3.0	−81.7	−77.6	45.8	285.2
1912–1917	11.2	6.5	74.1	−6.2	−3.2	−58.7	−58.7	17.3	82.5
1907–1912	5.1	3.6	90.7	−7.4	6.4	−55.8	−45.9	24.2	111.1
Electric railways:									
1907–1917	−39.0	−33.4	69.7	−56.0	−44.1	.....	.....	17.8	206.0
1912–1917	−28.2	−25.5	16.7	−38.2	−27.8	.....	−85.3	−4.9	37.7
1907–1912	−15.1	−10.7	45.4	−28.8	−22.6	.....	.....	23.9	122.3

[1] Not reported separately. [2] A minus sign (−) denotes decrease. Percentages are omitted when base is less than 100.

From Table 40 it appears that, while the number of electric railways having generating equipment has rapidly decreased during the decade from 569 in 1907 to 347 in 1917, the number of central electric stations of all kinds supplied with dynamos has steadily though slowly increased, the gain being only 16.8 per cent in 10 years. It is further significant to note that, whereas the number of such street railways *decreased* most rapidly between 1912 and 1917 (28.2 per cent), the number of central stations with generating equipment *increased* most rapidly (11.2 per cent) during this same period. At the present time, therefore, the street railways in this group form only 6.2 per cent of the total number of stations supplied with generating equipment. Further examination shows that the decrease (25.5 per cent) in the number of dynamos for electric railways has been almost as rapid as the decrease in the number of stations equipped with dynamos, whereas there has been a slight increase (6.5 per cent) in the case of the central stations. In kilowatt capacity, however, there has been a marked increase during the decade for both industries, 69.7 per cent for electric railways and 232 per cent for central stations. The increase during the past five years, however, has been very small, 16.7 per cent for electric railways as opposed to an increase of 74.1 per cent for central stations. The total kilowatt

capacity of all dynamos in 1917 was 11,919,186 and the total number was 15,508. From the figures given it is evident that electric railways report 13.4 per cent of the number of all dynamos and 24.5 per cent of their total capacity. Further, the average generating capacity for the street railways is 8,429 kilowatts per station and 1,406 kilowatts per machine as opposed to central station averages of 1,716 and 670, respectively.

It is scarcely worth while at present to make any separate study of the different types of dynamos reported under the heads of "Direct current" and "Alternating current." While in the earlier days direct-current dynamos were commonly used for generating power and for arc lighting, the well-known advantages which alternating current has over direct current in the matter of long-distance transmission and transformation into different voltages, so that it can be adapted to a wide variety of services, have led to a rapidly diminishing use of direct-current machines. It is interesting to find that at present direct-current constant-amperage dynamos are practically nonexistent. The actual number of direct-current generators of all kinds amounts to 26.1 per cent of the total number of dynamos reported by central electric stations and to 47.2 per cent of the total number returned by electric railways. Their kilowatt capacity, however, in both cases forms a negligible part of the total, being for central stations 4.9 per cent of the total capacity and for electric railways 18.2 per cent. The average size of these direct-current generators is 125 kilowatts in the central stations and 542 kilowatts in street railways, whereas the average size of the alternating-current dynamos is for the former 862 kilowatts and for the latter 2,179. Finally, since 1907 the electric railways have been subject to a decrease of 56 per cent in the number and 44.1 per cent in the kilowatt capacity of their direct-current constant-voltage dynamos, whereas for central stations the decrease in number has been only 13.2 per cent, while there has been a slight gain of 3 per cent in the kilowatt capacity, though the latter dropped a little during the past five years.

Dynamos of commercial and municipal stations compared.—Table 41 shows the number of commercial and municipal stations having generating equipment, together with the number and total capacity of all dynamos.

From the figures given in Table 41 it appears that in 1917 the dynamos of municipal plants comprised 25.6 per cent of the total number of all stations (3,437 as opposed to 9,991 reported by commercial stations), while their capacity amounted to only 6.5 per cent of the total kilowatt capacity for both groups (582,463 for municipal stations as contrasted with 8,411,944 for commercial stations). Further, it is significant that, while there has been practically no increase in the number of dynamos in commercial stations, the increase for municipal plants during the past decade has been 43.5 per cent, and the rate of increase has been more rapid during the last five years (24.2 per cent) than during the early five-year period (15.5 per cent). On the other hand, the increase in kilowatt capacity has been at both periods more marked in the case of the commercial plants, but the difference has been most noticeable since 1912, during which time commercial stations report a growth of 76.4 per cent in dynamo capacity as opposed to only 46.8 per cent reported by the municipal plants.

Table 41

CLASS OF STATIONS.	COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS.		
	Number of stations having generating equipment.	Total number of dynamos.	Total kilowatt capacity of dynamos.
Total:			
1917	5,243	13,428	8,994,407
1912	4,714	12,610	5,105,430
1907	4,487	12,173	2,709,225
Commercial:			
1917	3,417	9,991	8,411,944
1912	3,265	9,843	4,708,762
1907	(1)	9,778	2,500,209
Municipal:			
1917	1,826	3,437	582,463
1912	1,449	2,767	396,677
1907	(1)	2,395	209,016
	PER CENT OF INCREASE.		
Total:			
1907–1917	16.8	10.3	232.0
1912–1917	11.2	6.5	74.1
1907–1912	5.1	3.6	90.7
Commercial:			
1907–1917	(1)	2.2	236.4
1912–1917	4.7	1.5	76.4
1907–1912	(1)	0.7	90.7
Municipal:			
1907–1917	(1)	43.5	178.7
1912–1917	26.0	24.2	46.8
1907–1912	(1)	15.5	89.8

[1] Figures not available.

Though the figures no longer have any vital significance, it may not be amiss to call attention to the fact that in 1917 direct-current generators formed 26.4 per cent of the number of all dynamos reported by commercial plants and 25.2 per cent of the number reported by municipal plants. The relative kilowatt capacity of these dynamos is, respectively, 4.7 and 7.5 per cent of the total capacity reported by each group of plants. In 1912 municipal stations reported 807

direct-current generators having a capacity of 44,564 kilowatts, while commercial stations reported 3,345 with a capacity of 431,676 kilowatts. Five years later, however, the former reported 866 direct-current machines with a capacity of 43,864 kilowatts, while the latter returned 2,637 generators of this type with a total capacity of 392,823. These figures, accordingly, indicate a decrease of 21.2 per cent in the number of direct-current dynamos reported by commercial stations and an increase of 7.3 per cent in the number reported by municipal plants; but each group shows some decrease in the kilowatt capacity, the former 9 per cent and the latter 1.6 per cent. Many plants, of course, reported both alternating and direct current dynamos. There were, however, eight states—New Hampshire, Vermont, Rhode Island, Colorado, New Mexico, Arizona, Utah, and Nevada—in which municipal plants reported no direct-current generators, while in one state—Nevada—no such equipment was found in commercial stations.

In Table 42 is given the average kilowatt capacity of dynamos per station and per machine for the years 1917, 1912, and 1907. The averages per station are based upon the number of stations which reported generating equipment and not upon the total number of stations, many of which in 1912 and 1917 had no generating equipment. For 1907, however, it is now impossible to secure separate figures for commercial and municipal stations which had no equipment; hence for this year the averages for the two groups are based on the total number of stations reported, which was not widely different from the number having generating equipment.

Table 42 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—AVERAGE KILOWATT CAPACITY OF DYNAMOS PER STATION AND PER MACHINE.

AVERAGE KILOWATT CAPACITY.	Total.			Commercial.			Municipal.		
	1917	1912	1907	1917	1912	1907	1917	1912	1907
Per station	1,716	1,096	604	2,462	1,461	[1] 722	319	274	[1] 167
Per machine	670	410	223	842	484	256	169	143	87
Alternating and polyphase current	862	554	326	1,090	667	384	209	180	113
Direct current	125	115	91	149	129	100	51	55	48

[1] Average for 1907 is based on the total number of stations, both with and without generating equipment.

It appears from Table 42 that for all plants the average capacity per station has increased from 604 kilowatts in 1907 to 1,716 kilowatts in 1917, a growth of 184.1 per cent. The average capacity per commercial station practically doubled between 1907 and 1912, while during the next five-year period there was an increase of 68.5 per cent, from 1,461 to 2,462. Municipal plants during this same period experienced a growth of only 16.4 per cent, from 274 kilowatts in 1912 to 319 in 1917. The average size per machine has also shown a rapid increase during the past 10 years, particularly for commercial stations. In this group the average has increased from 256 to 842, or 228.9 per cent. Municipal plants, however, show a growth of less than 100 per cent, from an average of 87 kilowatts in 1907 to 169 in 1917. Further, it may be observed that alternating-current dynamos show a much higher kilowatt capacity per machine than do the direct-current dynamos. For commercial stations the figures for 1917 were, respectively, 1,090 and 149 kilowatts. The increase in the average capacity of alternating-current dynamos was for commercial plants 63.6 per cent between 1912 and 1917 and only 16.1 per cent for municipal plants. There has been no significant change in the average size of direct-current generators during the period.

The foregoing figures clearly indicate the rapid growth in size of stations and in the installation of the larger and more economically operated generating units for commercial plants during recent years. Municipal stations, on the other hand, have apparently confined themselves to the smaller units and have not been securing many of the gains which seem to come from combinations in the other group.

Dynamos, by geographic divisions and states and by kilowatt capacity.—Table 43 shows the total kilowatt capacity of dynamos for the different geographic divisions and states, the actual and percentage increases since 1907, and the per cent distribution. The Middle Atlantic and East North Central divisions together have at the last three censuses reported approximately 50 per cent of the dynamo capacity returned by all central stations. However, the most rapid rate of increase in dynamo capacity during the past 10 years is found in the East South Central division. In this division also there has been relatively the greatest increase in the percentage distribution of dynamo capacity as compared with the other divisions.

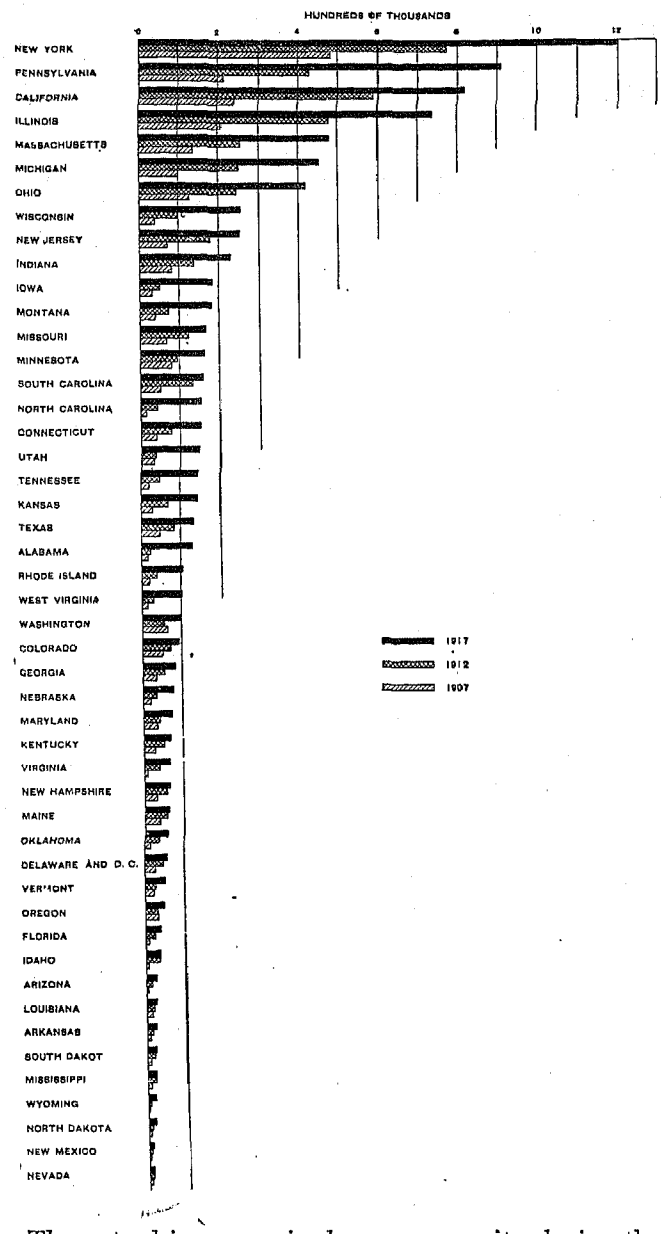
Among the several states, New York has led at all periods, reporting a dynamo capacity of 1,202,804 in 1917. This state was followed by Pennsylvania (910,434 kilowatts), California (817,194), and Illinois (737,621). New York alone reported 13.4 per cent of the total capacity for the United States, and these four states together report 40.8 per cent of the total capacity. There are also three other states which have a large dynamo capacity—Massachusetts (478,933), Michigan (451,276), and Ohio (420,481). Following this group there are three other states—Wisconsin, New Jersey, and Indiana—with a total capacity of somewhat more than 200,000, but no other states report so much as 200,000 kilowatts.

CENTRAL ELECTRIC STATIONS—TOTAL KILOWATT CAPACITY OF DYNAMOS, BY GEOGRAPHIC DIVISIONS AND STATES: 1917, 1912, AND 1907.

Table 43

DIVISION AND STATE.	TOTAL KILOWATT CAPACITY OF DYNAMOS.			Actual increase: 1907–1917	Per cent of increase: 1907–1917	PER CENT DISTRIBUTION.		
	1917	1912	1907			1917	1912	1907
UNITED STATES	8,994,407	5,165,439	2,709,225	6,285,182	232.0	100.0	100.0	100.0
GEOGRAPHIC DIVISIONS:								
New England	918,152	514,889	289,388	628,764	217.3	10.2	10.0	10.7
Middle Atlantic	2,362,759	1,378,811	765,140	1,597,619	208.8	26.3	26.7	28.2
East North Central	2,080,849	1,204,528	559,760	1,530,089	273.3	23.2	23.3	20.7
West North Central	780,138	404,172	245,252	534,886	218.1	8.7	7.8	9.1
South Atlantic	735,619	415,529	195,309	540,310	276.6	8.2	8.0	7.2
East South Central	366,532	150,042	77,059	289,473	375.6	4.1	2.9	2.8
West South Central	242,375	158,369	88,910	153,465	172.6	2.7	3.1	3.3
Mountain	533,997	261,119	151,032	382,965	253.6	5.9	5.1	5.6
Pacific	964,986	677,980	337,375	627,611	186.0	10.7	13.1	12.5
NEW ENGLAND:								
Maine	63,242	58,757	39,290	23,952	61.0	6.9	11.4	13.6
New Hampshire	65,560	57,768	31,917	33,643	105.4	7.1	11.2	11.0
Vermont	51,751	29,468	21,854	29,897	136.8	5.6	5.7	7.6
Massachusetts	478,933	252,732	135,924	343,009	252.4	52.2	49.1	47.0
Rhode Island	106,017	38,509	21,040	84,977	403.9	11.5	7.5	7.3
Connecticut	152,649	77,655	39,363	113,286	287.8	16.6	15.1	13.6
MIDDLE ATLANTIC:								
New York	1,202,804	772,030	482,031	720,773	149.5	50.9	56.0	63.0
New Jersey	249,521	179,477	70,566	178,955	253.6	10.6	13.0	9.2
Pennsylvania	910,434	427,304	212,543	697,891	328.4	38.5	31.0	27.8
EAST NORTH CENTRAL:								
Ohio	420,481	244,182	126,533	293,948	232.3	20.1	20.3	22.6
Indiana	227,825	135,801	81,576	146,249	179.3	10.9	11.3	14.6
Illinois	737,621	477,917	209,226	528,395	252.5	35.3	39.7	37.4
Michigan	451,276	247,789	101,714	349,562	343.7	21.6	20.6	18.2
Wisconsin	252,646	98,839	40,711	211,935	520.6	12.1	8.2	7.3
WEST NORTH CENTRAL:								
Minnesota	162,854	93,502	78,516	84,338	107.4	20.9	23.1	32.0
Iowa	184,506	53,237	32,056	152,450	475.6	23.6	13.2	13.1
Missouri	166,813	122,786	68,467	98,346	143.6	21.4	30.4	27.9
North Dakota	20,041	10,824	5,819	14,222	244.4	2.6	2.7	2.4
South Dakota	24,323	20,032	10,046	14,277	142.1	3.1	5.0	4.1
Nebraska	78,227	34,586	20,041	58,186	290.3	10.0	8.6	8.2
Kansas	143,374	69,205	30,307	113,067	373.1	18.4	17.1	12.4
SOUTH ATLANTIC:								
Delaware, District of Columbia, and Maryland	131,288	89,887	62,956	68,332	108.5	17.8	21.6	32.2
Virginia	65,913	40,512	9,195	56,718	616.8	9.0	9.7	4.7
West Virginia	103,611	29,772	14,726	88,885	603.6	14.1	7.2	7.5
North Carolina	153,410	43,099	13,911	139,499	1,002.8	20.9	10.4	7.1
South Carolina	159,255	132,408	51,271	107,984	210.6	21.6	31.9	26.3
Georgia	84,330	56,232	35,446	48,884	137.9	11.5	13.5	18.1
Florida	37,812	23,619	7,804	30,008	384.5	5.1	5.7	4.0
EAST SOUTH CENTRAL:								
Kentucky	69,442	54,062	29,140	40,302	138.3	18.9	36.0	37.8
Tennessee	145,336	49,640	20,911	124,424	595.0	39.7	33.1	27.1
Alabama	128,509	24,477	17,124	111,385	650.5	35.1	16.3	22.2
Mississippi	23,246	21,863	9,884	13,362	135.2	6.3	14.6	12.8
WEST SOUTH CENTRAL:								
Arkansas	24,913	16,335	9,678	15,235	157.4	10.3	10.3	10.9
Louisiana	25,762	19,169	15,175	10,587	69.8	10.6	12.1	17.1
Oklahoma	57,783	38,301	15,499	42,284	272.8	23.8	24.2	17.4
Texas	133,917	84,564	48,558	85,359	175.8	55.3	53.4	54.6
MOUNTAIN:								
Montana	182,079	74,398	39,602	142,477	359.8	34.1	28.5	26.2
Idaho	37,103	35,656	7,082	30,021	423.9	6.9	13.7	4.7
Wyoming	20,627	8,212	3,208	17,419	543.0	3.9	3.1	2.1
Colorado	94,791	71,668	53,130	41,661	78.4	17.8	27.4	35.2
New Mexico	12,713	7,981	3,789	8,924	235.5	2.4	3.1	2.5
Arizona	26,972	14,756	4,939	22,033	446.1	5.0	5.7	3.3
Utah	147,359	37,935	33,592	113,767	338.7	27.6	14.5	22.2
Nevada	12,353	10,513	5,690	6,663	117.1	2.3	4.0	3.8
PACIFIC:								
Washington	99,875	57,283	66,308	33,567	50.6	10.3	8.4	19.7
Oregon	47,917	32,416	32,587	15,330	47.0	5.0	4.8	9.7
California	817,194	588,281	238,480	578,714	242.7	84.7	86.8	70.7

DIAGRAM 8.—KILOWATT CAPACITY OF DYNAMOS, BY STATES: 1917, 1912, AND 1907.



The actual increases in dynamo capacity during the decade have been greatest in New York (720,773), Pennsylvania (697,891), California (578,714), and Illinois (528,395). During the past five years also the most marked increases have taken place in Pennsylvania (483,130) and in New York (430,774), while four other states—Illinois, California, Massachusetts, and Michigan—show increases ranging between 200,000 and 260,000 kilowatts. The most rapid rate of increase during the decade, as well as during the past five years, was found in North Carolina and in Alabama.

In Table 44 (p. 68) are shown the number and kilowatt capacity of central electric stations, grouped according to their total kilowatt capacity, both for the United States and for the various geographic divisions, for 1917, 1912, and 1907.

It is significant to find that while the total number of stations supplied with generating equipment has increased only 16.8 per cent during the decade, from 4,487 in 1907 to 5,243 in 1917, the number having no generating equipment has increased during the same period from 227 to 1,299, or 472.2 per cent. So far as the United States totals are concerned, it appears that the *number* of stations having a capacity under 200 kilowatts has been at all times most numerous, though the total *capacity* of this group has always been very low. There has not, however, been any marked difference in the aggregate kilowatt capacity of stations in the three lowest groups. There has been since 1907 a slight increase in the number of stations in the lowest group (10.2 per cent), but there has been a corresponding decrease in the kilowatt capacity (10 per cent). During the past five years there has been a slight decrease in the number of stations with a capacity between 200 and 500 kilowatts as well as in the number of those grouped between 500 and 1,000 kilowatts. During the same time the total capacity of these groups has remained practically stationary. The only marked increase both in number and in kilowatt capacity has been in the group reporting 5,000 kilowatts or more. In this group the kilowatt capacity has doubled during the last five years and quintupled during the decade. An examination of the different geographic divisions discloses the fact that, while in most cases there has been a decrease in the number and kilowatt capacity of the smaller groups of stations, the West North Central, South Atlantic, and West South Central divisions have shown a marked increase for the decade in the number of stations reporting less than 200 kilowatts, 71.2, 54, and 43.7 per cent, respectively. In the next group also the West North Central division shows a 65 per cent increase in the number of stations and 70 per cent increase in total capacity. These figures indicate the rapid growth of small generating stations, largely under individual, firm, or municipal ownership, in the divisions mentioned. The rate of increase in the total kilowatt capacity of the highest group of stations since 1907 has been greatest (2,528.2 per cent) in the East South Central division, which in 1907 reported only 1 station with a capacity of 11,100 kilowatts. This division is followed in rate of increase by the West South Central (852.2 per cent), the New England (584 per cent), the East North Central (569.9 per cent), and the Mountain (497.8 per cent).

CENTRAL ELECTRIC STATIONS—NUMBER, BY DYNAMO CAPACITY AND BY GEOGRAPHIC DIVISIONS: 1917, 1912, AND 1907.

Table 44

DIVISION[1] AND CENSUS YEAR.	NUMBER OF STATIONS.		STATIONS GROUPED ACCORDING TO DYNAMO CAPACITY.													
			Total.		Under 200 kilowatts.		200 and under 500 kilowatts.		500 and under 1,000 kilowatts.		1,000 and under 2,000 kilowatts.		2,000 and under 5,000 kilowatts.		5,000 kilowatts and over.	
	Total.	Having no generating equipment.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.
UNITED STATES:																
1917	6,542	1,299	5,243	8,994,407	3,348	236,216	899	272,224	335	226,987	242	336,689	182	577,120	237	7,345,171
1912	5,221	507	4,714	5,165,439	2,902	250,571	948	278,505	337	228,885	214	301,495	152	464,993	161	3,640,990
1907	4,714	227	4,487	2,709,225	3,038	262,601	821	246,015	269	182,664	169	228,313	115	356,821	75	1,432,811
Per cent of increase[2]—																
1907–1917	38.8	472.2	16.8	232.0	10.2	−10.0	9.5	10.6	24.5	24.3	43.2	47.5	58.3	61.7	.....	412.6
1912–1917	25.3	156.2	11.2	74.1	15.4	−5.7	−5.2	−2.3	−0.6	−0.8	13.1	11.7	19.7	24.1	47.2	101.7
1907–1912	10.8	123.3	5.0	90.7	−4.5	−4.6	15.5	13.2	25.3	25.3	26.6	32.1	32.2	30.3	.....	154.1
NEW ENGLAND.																
1917	383	128	255	918,152	82	7,146	44	13,985	31	20,734	39	52,071	26	98,688	33	725,528
1912	368	77	291	514,889	102	9,609	64	20,300	39	27,255	36	50,260	26	79,047	24	328,418
1907	365	37	328	280,388	147	13,760	74	24,544	41	27,867	35	50,415	22	66,725	9	106,077
Per cent of increase[2]—																
1907–1917	4.9	.....	−22.3	217.3	−44.2	−48.1	.....	−43.0	.....	−25.6	.....	3.3	.....	47.9	.....	584.0
1912–1917	4.1	.....	−12.4	78.3	−19.6	−25.6	.....	−31.1	.....	−23.9	.....	3.6	.....	24.8	.....	120.9
1907–1912	0.8	.....	−11.3	77.9	−30.6	−30.2	.....	−17.3	.....	−2.2	.....	−0.3	.....	18.5	.....	209.6
MIDDLE ATLANTIC:																
1917	679	179	500	2,362,759	191	17,692	126	37,932	52	34,308	43	58,500	31	93,947	57	2,120,290
1912	669	99	570	1,378,811	249	23,823	144	43,851	66	46,037	43	61,815	36	108,018	32	1,095,267
1907	705	62	643	765,140	334	31,928	150	46,459	72	50,424	41	52,574	28	82,889	18	500,866
Per cent of increase[2]—																
1907–1917	−3.7	.....	−22.2	208.8	−42.8	−44.6	−16.0	−18.4	.....	−31.8	.....	11.3	.....	13.3	.....	323.3
1912–1917	1.5	.....	−12.3	71.4	−23.3	−25.7	−12.5	−13.5	.....	−25.3	.....	−5.4	.....	−13.0	.....	93.6
1907–1912	−5.1	.....	−11.4	80.2	−25.4	−25.4	−4.0	−5.6	.....	−8.7	.....	17.6	.....	30.3	.....	118.7
EAST NORTH CENTRAL:																
1917	1,385	304	1,081	2,089,849	660	50,470	208	63,872	73	49,778	56	79,705	35	115,443	49	1,730,581
1912	1,260	106	1,154	1,204,528	723	64,843	241	70,782	76	50,290	54	75,376	30	96,947	30	846,290
1907	1,295	21	1,274	559,760	906	79,935	229	66,357	70	47,633	34	41,158	22	66,384	13	258,343
Per cent of increase[2]—																
1907–1917	6.9	.....	−15.2	273.3	−27.2	−36.9	−9.2	−3.8	.....	4.5	.....	93.6	.....	74.0	.....	569.9
1912–1917	9.9	186.8	−6.3	73.5	−8.7	−22.2	−13.7	−9.8	.....	−1.0	.....	5.7	.....	19.1	.....	104.5
1907–1912	−2.7	.....	−9.4	115.2	−20.2	−18.9	5.2	6.7	.....	5.6	.....	83.1	.....	46.1	.....	227.6
WEST NORTH CENTRAL:																
1917	1,730	324	1,406	780,138	1,063	64,744	193	58,359	62	42,867	43	62,689	26	80,413	19	471,066
1912	1,077	57	1,020	404,172	760	60,340	166	47,739	54	36,761	16	23,532	12	36,515	12	199,285
1907	800	12	788	245,252	621	51,556	117	34,327	25	15,714	13	17,798	5	15,420	7	110,437
Per cent of increase—																
1907–1917	116.2	.....	78.4	218.1	71.2	25.6	65.0	70.0	.....	172.8	.....	252.2	.....	421.5	.....	326.5
1912–1917	60.6	.....	37.8	93.0	39.9	7.3	16.3	22.2	.....	16.6	.....	166.4	.....	120.2	.....	136.4
1907–1912	34.6	.....	29.4	64.8	22.4	17.0	41.9	39.1	.....	133.9	.....	32.2	.....	136.8	.....	80.5
SOUTH ATLANTIC:																
1917	728	143	585	735,619	385	27,452	108	32,067	33	23,186	13	16,990	23	68,802	23	567,122
1912	512	54	458	415,529	278	24,825	107	31,313	28	18,953	17	22,304	13	35,747	15	282,297
1907	390	14	376	195,309	250	22,180	90	26,663	11	7,655	10	13,758	8	21,634	7	103,419
Per cent of increase—																
1907–1917	86.7	.....	55.6	276.6	54.0	23.8	.....	20.3	.....	202.9	.....	23.5	.....	218.0	.....	448.4
1912–1917	42.2	.....	27.7	77.0	38.5	10.6	0.9	2.4	.....	22.3	.....	−24.1	.....	92.5	.....	100.9
1907–1912	31.3	.....	21.8	112.8	11.2	11.9	.....	17.4	.....	147.6	.....	62.8	.....	65.2	.....	173.0
EAST SOUTH CENTRAL:																
1917	410	24	386	366,532	291	18,792	59	17,999	10	7,135	11	16,003	5	14,875	10	291,728
1912	330	8	322	150,042	216	15,522	69	19,499	15	10,900	8	11,384	6	17,712	8	72,025
1907	284	2	282	77,059	219	19,394	46	13,285	7	4,961	3	4,795	6	23,524	1	11,100
Per cent of increase[2]—																
1907–1917	44.4	.....	36.9	375.6	32.9	−3.1	.....	35.5	.....	43.8	.....	233.7	.....	−36.8	.....	2,528.2
1912–1917	24.2	.....	19.9	144.3	34.7	1.4	.....	−7.7	.....	−34.6	.....	40.6	.....	−16.0	.....	305.0
1907–1912	16.2	.....	14.2	94.7	−1.4	−4.5	.....	46.8	.....	119.7	.....	137.4	.....	−24.7	.....	548.9
WEST SOUTH CENTRAL:																
1917	636	43	593	242,375	447	33,799	82	23,958	27	18,034	16	23,755	12	42,847	9	99,982
1912	507	9	498	158,369	362	30,097	87	23,769	24	15,175	11	16,007	9	30,172	5	42,549
1907	395	3	392	88,910	311	23,625	52	15,187	13	8,865	8	12,125	6	18,608	2	10,500
Per cent of increase—																
1907–1917	61.0	.....	51.3	172.6	43.7	43.1	.....	57.8	.....	103.4	.....	95.9	.....	130.3	.....	852.2
1912–1917	25.4	.....	19.1	53.0	23.5	10.1	.....	0.8	.....	18.8	.....	48.4	.....	42.0	.....	135.0
1907–1912	28.4	.....	27.0	78.1	16.4	29.9	.....	56.5	.....	71.2	.....	32.0	.....	62.1	.....	305.2
MOUNTAIN:																
1917	337	70	267	533,997	143	10,336	54	16,216	34	22,420	13	16,751	10	26,172	13	442,102
1912	250	34	216	261,119	107	9,791	44	13,674	24	14,996	18	25,556	8	21,200	15	175,902
1907	219	23	196	151,032	119	9,975	32	9,931	20	13,302	9	12,807	10	31,067	6	73,950
Per cent of increase[2]—																
1907–1917	53.9	.....	36.2	253.6	20.2	3.6	.....	63.3	.....	68.5	.....	30.8	.....	−15.8	.....	497.8
1912–1917	34.8	.....	23.6	104.5	33.6	5.6	.....	18.6	.....	49.5	.....	−34.5	.....	23.4	.....	151.3
1907–1912	14.2	.....	10.2	72.9	−10.1	−1.8	.....	37.7	.....	12.7	.....	99.5	.....	−31.8	.....	137.9
PACIFIC:																
1917	254	84	170	964,986	86	5,785	25	7,836	13	8,435	8	10,225	14	35,933	24	896,772
1912	248	63	185	677,980	105	8,121	26	7,578	11	8,518	11	15,171	12	39,635	20	598,957
1907	261	53	208	337,375	131	10,248	31	9,262	10	6,243	16	22,883	8	30,620	12	258,119
Per cent of increase[2]—																
1907–1917	−2.7	.....	−18.3	186.0	−34.4	−43.6	.....	−15.4	.....	35.1	.....	−55.3	.....	17.4	.....	247.5
1912–1917	2.4	.....	−8.1	42.3	−18.1	−28.8	.....	3.4	.....	−1.0	.....	−32.6	.....	−9.4	.....	49.7
1907–1912	−5.0	.....	−11.1	101.0	−19.8	−20.8	.....	−18.2	.....	36.4	.....	−33.7	.....	29.4	.....	132.0

[1] See p. 18 for states composing the several geographic divisions.

[2] A minus sign (−) denotes decrease. Percentages are omitted when base is less than 100.

Perhaps a tabular view of the percentage distribution of generating stations according to kilowatt capacity reported will best show the relative importance of the different groups. From Table 45, accordingly, it appears that the number of stations reporting less than 200 kilowatts forms at present 63.9 per cent of all generating stations, but this group reports only 2.6 per cent of the kilowatt capacity. There have not been marked changes in the relative number of stations in most groups, except in that reporting more than 5,000 kilowatts. Stations of this size formed only 1.7 per cent of the total in 1907 and 4.5 per cent in 1917. In total kilowatt capacity, however, there has been a rapid decrease in relative importance for every group except the highest, which has increased from 52.9 per cent in 1907 to 81.7 per cent in 1917.

Table 45

PERCENTAGE DISTRIBUTION OF GENERATING STATIONS, ACCORDING TO KILOWATT CAPACITY OF DYNAMOS AND AVERAGE KILOWATT CAPACITY PER STATION: 1917, 1912, AND 1907.

	Census year.	Under 200 kilowatts.		200 and under 500 kilowatts.		500 and under 1,000 kilowatts.		1,000 and under 2,000 kilowatts.		2,000 and under 5,000 kilowatts.		5,000 kilowatts and over.	
		Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.	Number of stations.	Kilowatt capacity.
Per cent of total stations with generating equipment	1917	63.9	2.6	17.1	3.0	6.4	2.5	4.6	3.7	3.5	6.4	4.5	81.7
	1912	61.6	4.9	20.1	5.4	7.1	4.4	4.5	5.8	3.2	9.0	3.4	70.5
	1907	67.7	9.7	18.3	9.1	6.0	6.7	3.8	8.4	2.6	13.2	1.7	52.9
Average station capacity	1917	.....	71	.....	303	.....	678	.....	1,391	.....	3,171	.....	30,992
	1912	.....	86	.....	294	.....	679	.....	1,409	.....	3,059	.....	22,615
	1907	.....	80	.....	300	.....	679	.....	1,351	.....	3,103	.....	19,104

It is interesting to note the average capacity of stations grouped according to size. As has already been pointed out, the average capacity per generating station increased from 604 kilowatts in 1907 to 1,716 in 1917. The average capacity of those numerous stations in the lowest group was in 1917 only 71 kilowatts, a decrease of 15 since 1912. This is almost unbelievably low; yet 63.9 per cent of all generating stations in the United States were of this average size. In the next four groups there has been practically no change in the average during the past 10 years. In the highest group, however, the increase in size has been very marked, particularly between 1912 and 1917, when the increase from 22,615 to 30,992 kilowatts amounted to 37 per cent. Finally, the average capacity per station in this group is highest (37,366 kilowatts) in the Pacific division. Next in order come the Middle Atlantic (37,198), the East North Central (35,318), and the Mountain (34,008). The division reporting the lowest average capacity of stations in this group is the West South Central, with only 11,109 kilowatts. The others range between 20,000 and 30,000 kilowatts.

Dynamos classified according to motive power used.—In the present census an attempt was made to secure the number and total capacity of dynamos operated solely by water wheels or turbines as contrasted with the number and capacity of those operated by other kinds of primary power. While it was in some instances practically impossible for stations to make a proper classification on this basis, due to the fact that the same dynamo would be operated at certain times during the year by water power and at other times, when the water power was low, perhaps by steam, the figures can not be taken as absolutely accurate, but they do indicate with reasonable clearness the extent to which water power is used in the generation of electric current. It should be noted that many water-power plants have a primary horsepower somewhat in excess of that which is needed for the operation of their dynamos, due to the fact that they have anticipated future developments in the electrical industry or because they are engaged in furnishing mechanical power to other concerns. Hence it is to be expected that the proportion of the total dynamo capacity reported as operated by water power will be somewhat less than the proportion which the primary water power returned bears to the total primary horsepower of all kinds.

The relative number and capacity of dynamos operated by water power, together with their average capacity, are compared in Table 46 with the data for generators operated by other kinds of power.

Table 46

CENTRAL ELECTRIC STATIONS—DYNAMOS CLASSIFIED ACCORDING TO PRIMARY POWER USED IN OPERATING: 1917.

	Operated by water power.		Operated by other power.		Average size.	
	Number.	Kilowatt capacity.	Number.	Kilowatt capacity.	Operated by water power.	Operated by other power.
Total	2,877	2,785,897	10,551	6,208,510	968	588
Commercial	2,646	2,661,820	7,345	5,750,124	1,006	783
Municipal	231	124,077	3,206	458,386	537	143
	PER CENT DISTRIBUTION.					
Total	21.4	31.0	78.6	69.0	.....	.....
Commercial	26.5	31.6	73.5	68.4	.....	.....
Municipal	6.7	21.3	93.3	78.7	.....	.....

It is found from Table 46 that for all stations 2,877 machines having a capacity of 2,785,897 kilowatt hours were operated by water power. These units form 21.4 per cent of the total in number and 31 per cent in kilowatt capacity. In average size, however, it appears that this group of dynamos is 64.6 per cent larger (968 kilowatts) than the average for those operated by other power (588 kilowatts). It is further interesting to find that commercial stations reported 26.5 per cent of their total number of dynamos and 31.6 per cent of their capacity as operated by water power, whereas the dynamos so operated by municipal plants comprised only 6.7 per cent of the total number which they reported and 21.3 per cent of the capacity. Finally, the average size of dynamos operated by water power is for commercial plants 1,006 kilowatts, or 28.5 per cent greater than the average size of machines operated by other power. Municipal plants, on the other hand, report an average size of 537 kilowatts, which is 275.5 per cent larger than the average for units operated by other sources of power. In this connection it should be recalled that the proportion which the horsepower of water wheels and turbines bears to the total primary power reported in either case is for commercial stations 33.8 per cent and for municipal plants 23.3 per cent.

Generating equipment not in use.—Before leaving this subject attention should be called to the fact that most large stations have a certain amount of reserve generating equipment which is not necessarily used much of the time. It frequently happens that antiquated equipment will accordingly be retained for use in cases of emergency resulting from breakdown, etc. Naturally, it is impossible to know what proportion of total dynamo capacity is represented by such machines. Data are available, however, in the case of those plants which, while having generating equipment, did not utilize it during the year. In 1917 there were 119 of these—70 commercial and 49 municipal. In 1912 there were 45 commercial stations and 23 municipal stations which did not use their generating equipment but purchased all current sold. The total dynamo capacity reported by such stations in 1917 was 50,984 kilowatts, an average of 428 kilowatts per station as opposed to the average for all generating stations of 1,716 kilowatts, which is about four times as great. That these stations were relatively unimportant is further indicated by the fact that, while they comprised 1.8 per cent of all stations in the United States, their output, which was entirely purchased current (177,983,122 kilowatt hours), was less than six-tenths of 1 per cent of the total output, both generated and purchased, for all stations. It is not surprising to find a slight growth in the relative number of such plants since 1912 (from 1.3 per cent to 1.8 per cent of the total), due to the fact that many have found it more economical to purchase current than to continue generation when the price of fuel is so high. It should further be remembered that many plants which have once generated current, upon ceasing to do so frequently sell their equipment. Hence the figures here given indicate only in the vaguest sort of way the number of plants which have ceased to generate current. Finally, it should also be noted that all of those plants which during the year generate any current, no matter how little, are included as generating stations. Many of these, however, had a large amount of equipment which was idle practically all of the time and which may eventually be discarded altogether.

Stations without generating equipment.—Those central stations which purchase all of their current comprise not only the relatively small number which have generating equipment not in use, but also the much larger group having no generating equipment whatever. These in turn were in some cases formerly generating stations which have now disposed of their equipment, though in a majority of instances they were no doubt originally constructed merely as purchasing plants. Whatever may have been their ancient history, the number of stations without generating equipment has increased with great rapidity, both absolutely and relatively, between the different census periods, and particularly since 1912. In 1902 there were 78 such stations, or 2.2 per cent of the total number. The figures had increased by 1907 to 227, or 4.8 per cent of the total, a growth of 191 per cent. By 1912 there had been a further increase to 507, or 123.3 per cent, equal to 9.7 per cent of all stations. In 1917 the number of stations without generating equipment reported was 1,299, or 19.9 per cent of the total. This was a growth of 156.2 per cent during the five-year period and an absolute increase of 792.

An examination of Table 47 shows that the number of municipal plants without generating equipment increased at a more rapid rate (335.4 per cent) than did commercial plants (104.8 per cent). While there were 113 of the former without generating equipment in 1912 and 492 in 1917, there were 394 and 807 corresponding commercial plants reported at the same

dates. For commercial and municipal stations combined the number of plants in this group is highest in the West North Central division (324) and in the East North Central division (304), while the lowest number is to be found in the East South Central (24) and the West South Central (43). Relative to the total number of stations reported in the various divisions, the number having no generating equipment is highest in the New England division (33.4 per cent), followed by the Pacific division (33.1 per cent), the Middle Atlantic (26.4 per cent), and the East North Central (21.9 per cent). It is further interesting to find that commercial stations report the highest number without generating equipment (187) in the East North Central division. This is followed by the Middle Atlantic (155) and the West North Central (137). Municipal plants, on the other hand, show the highest figures in the West North Central (187), followed by the East North Central (117). The relatively highest number of such plants was reported by commercial stations in the New England division, where they comprised about 30 per cent of the total number of commercial stations in the division, followed by the Middle Atlantic division, with nearly 28 per cent, whereas municipal plants show the highest proportion, almost 48 per cent, in the Pacific division, closely followed by the New England division, with about 46 per cent.

Table 47 TOTAL NUMBER OF COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS, AND NUMBER HAVING NO GENERATING EQUIPMENT, BY GEOGRAPHIC DIVISIONS.

DIVISION[1] AND CENSUS YEAR.	Total.				Number of stations.			
	All stations.		No generating equipment.		Commercial.		Municipal.	
	Number.	Per cent distribution.	Number.	Per cent of total.	Total.	No generating equipment.	Total.	No generating equipment.
United States:								
1917	6,542	100.0	1,299	19.9	4,224	807	2,318	492
1912	5,221	100.0	507	9.7	3,659	394	1,562	113
New England:								
1917	383	5.8	128	33.4	311	95	72	33
1912	368	7.0	77	20.9	311	61	57	16
Middle Atlantic:								
1917	679	10.4	179	26.4	556	155	123	24
1912	669	12.8	99	14.8	567	92	102	7
East North Central:								
1917	1,385	21.2	304	21.9	818	187	567	117
1912	1,260	24.1	106	8.4	786	82	474	24
West North Central:								
1917	1,730	26.4	324	18.7	970	137	760	187
1912	1,077	20.6	57	5.3	678	37	399	20
South Atlantic:								
1917	728	11.1	143	19.6	398	72	330	71
1912	512	9.8	54	10.5	308	31	204	23
East South Central:								
1917	410	6.3	24	5.9	256	17	154	7
1912	330	6.3	8	2.4	202	6	128	2
West South Central:								
1917	636	9.7	43	6.8	445	32	191	11
1912	507	9.7	9	1.8	385	7	122	2
Mountain:								
1917	337	5.2	70	20.8	264	51	73	19
1912	250	4.8	34	13.6	211	28	39	6
Pacific:								
1917	254	3.9	84	33.1	206	61	48	23
1912	248	4.8	63	25.4	211	50	37	13

[1] See p. 18 for states composing the several geographic divisions.

CHAPTER VI.—OUTPUT AND DISPOSAL OF CURRENT.

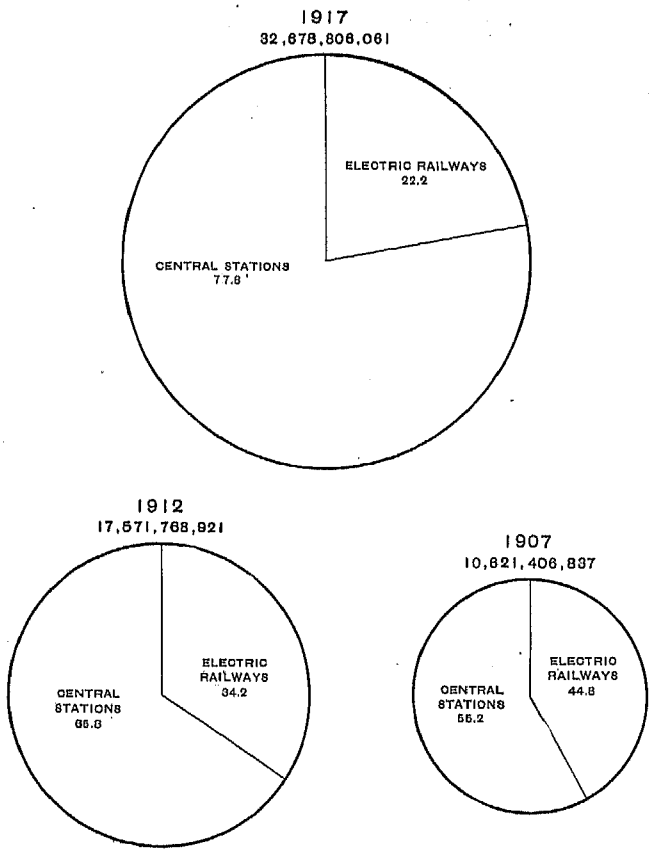
Kilowatt hours generated.—While it is interesting to know the amount of generating capacity which is possessed by the central stations and electric railways of the United States, the extent to which that capacity is used is far more significant. Hence, careful attention must be given to the number of kilowatt hours generated by the different groups of stations. Accordingly, Table 48 shows for electric railways and for central stations, classified according to commercial and municipal ownership, the amount of current generated for the three census periods 1917, 1912, and 1907, with percentages of increase for the decade and for the two five-year periods.

Table 48 CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—KILOWATT HOURS GENERATED.

	1917	1912	1907
Total	32,678,806,061	17,571,768,921	10,621,406,837
Central stations	25,438,303,272	11,569,109,885	5,862,276,737
Commercial	24,398,983,183	11,031,583,155	5,572,813,949
Municipal	1,039,320,089	537,526,730	289,462,788
Electric railways	7,240,502,789	6,002,659,036	4,759,130,100
	PER CENT OF TOTAL.		
Central stations	77.8	65.8	55.2
Commercial	74.6	62.7	52.5
Municipal	3.2	3.1	2.7
Electric railways	22.2	34.2	44.8
	PER CENT OF INCREASE.		
	1907–1917	1912–1917	1907–1912
Total	207.7	86.0	65.4
Central stations	333.9	119.9	97.3
Commercial	337.8	121.2	98.0
Municipal	259.1	93.4	85.7
Electric railways	52.1	20.6	26.1

Earlier figures were to a large extent merely estimates, as many stations did not before 1907 measure their current either at the switchboard or when delivered to customers. This suggestion, of course, applies more specifically to central stations than to street railways. In 1907, also, no distinction was made between current generated and current purchased, and consequently there was some duplication in the figures for that date, though at the time comparatively little current was sold to other companies. Finally, mention should be made of the fact that even in 1917 a large number of the smaller central stations did not make any attempt to measure the quantity of current produced, so that the figures which they have returned are merely their best estimates, based on the extent and nature of their business. It is felt, however, that as a result of the extended correspondence and careful checking in connection with this inquiry on the schedule, the figures here presented, relating to the output and disposal of current for 1917, are as nearly correct as human effort could make them in the limited time available.

DIAGRAM 9.—KILOWATT HOURS GENERATED: 1917 1912, AND 1907.



It is significant to find that the total number of kilowatt hours generated by central stations and electric railways has more than trebled since 1907, until in 1917 the figures stand at 32,678,806,061 kilowatt hours. The increase, both for the decade and during the past five years, was far more marked in the case of electric light and power plants than in the case of street railways. The former show a gain of 333.9 per cent since 1907, or nearly 20,000,000,000 kilowatt hours. The latter during the same period increased their current generated by only 52.1 per cent, or about 2,500,000,000 kilowatt hours. Between 1912 and 1917 electric street railways experienced a much smaller increase than that shown for central stations, 20.6 per cent for the former as opposed to 119.9 per cent for the latter. At all periods, also, the growth in current produced has been markedly

more rapid for commercial than for municipal plants. A study of the per cent of the total which was at the different periods generated by the respective groups shows that electric railways were in 1917 relatively only half so important as in 1907. At the former date they generated only 22.2 per cent of all current, whereas in 1907 they produced 44.8 per cent. For central stations, on the other hand, commercial plants have shown an equally marked growth in the importance of their generation of current, which increased from 52.5 per cent of the total in 1907 to 74.6 per cent in 1917. Municipal plants have done little more than maintain their status quo in relation to the other groups. They generated 2.7 per cent of all current in 1907, 3.1 per cent in 1912, and 3.2 per cent in 1917. As compared with the total output of central stations only, however, municipal plants have been subject to a decrease in relative amount of current generated, from 4.9 per cent in 1907 to 4.6 per cent in 1912, and 4.1 per cent in 1917.

It is of interest to the student of the problem to study the changes which have taken place in the nature of the business done by central electric stations in recent years. As is well understood, a comparatively high initial investment in plant and equipment of various kinds is needed in order to make it possible to generate current at all. Once this investment is made, however, the aim of the management should be to keep the dynamos in use to full capacity for as many hours per day as possible. In other words, it is necessary to see that the capital invested is constantly earning the highest possible return on itself. Consequently, when the lighting business of a central station has been built up, every effort is or should be made to secure a profitable power or heating business, etc., which will enable the dynamos to be kept busy during the daytime when otherwise the load on the station would be negligible. Accordingly, the larger and more progressive plants frequently find it highly desirable to make unusually low rates to those customers who wish to be served during the day at "off peak" times, for the only appreciable additional expense to which they are put in furnishing current under these circumstances is the mere cost of the extra fuel which may be required at the generating station. All the overhead expenses go on just the same, and even a considerable quantity of fuel is needed in the case of steam plants to bank fires under the boilers at times when the station load is light.

By comparing the amount of current actually generated by the different groups of plants during the year with the amount which they could theoretically have produced had the dynamos been in use to their full capacity for 24 hours per day and 365 days per year, it is possible to see the changes which have taken place in the character of the business carried on by central stations even though the actual output of current for the different services might not be known. Table 49 shows the number of hours' use of maximum generating capacity both for electric railways and central stations in 1912 and 1917. No satisfactory data could be computed for 1907, owing to the fact, as previously stated, that purchased current was included with current generated when the returns were made, and also because of the fact that a very considerable amount of current generated was not measured at the earlier date.

Table 49 NUMBER OF HOURS' USE OF MAXIMUM GENERATING CAPACITY: 1917 AND 1912.

	1917	1912	Per cent of increase.	Per cent of possible use.	
				1917	1912
Central stations	7.75	6.14	26.2	32.3	25.6
Commercial	7.95	6.34	25.4	33.1	26.4
Municipal	4.89	3.71	31.8	20.4	15.5
Electric railways	6.78	6.56	3.4	28.3	27.3

Electric railways seem to have made little change in the nature of their business in spite of the fact that they sell an appreciable amount of current for power other than car lines (1,788,913,277 kilowatt hours in 1917). While their dynamos reported were in use to maximum capacity for 6.56 hours per day in 1912, the number of hours' use per day had increased to 6.78 in 1917, or 3.4 per cent. Central stations, on the other hand, report an increase from 6.14 hours' use of maximum capacity to 7.75, a gain of 26.2 per cent during the five-year period. Commercial stations have not experienced so rapid a growth in this respect as have municipal plants (25.4 per cent as opposed to 31.8 per cent), but this is no doubt largely occasioned by the fact that in 1912 the former had already developed many lines of service in addition to electric lighting, while the latter then confined themselves almost solely to this one form of activity. In spite of the per cent of increase during the last five years, the actual discrepancy between the two was greater in 1917 than in 1912. At the earlier date commercial stations used their maximum capacity on an average of 6.34 hours per day, or 2.63 more hours than did the municipal plants. In 1917, on the other hand, their generators were busy almost a third of the time, 7.95 hours per day as opposed to only 4.89 hours for municipal plants. The difference, 3.06 hours, shows that commercial stations were operating to fullest capacity for 62.6 per cent more time than were the other group.

Table 50, which shows, by geographic divisions and states, the number of kilowatt hours generated by all central electric stations in the United States in 1917, 1912, and 1907, will no doubt be of interest to the various localities concerned. During the decade, as well as during the past five years, the actual increase

in amount of current produced was greatest for the Middle Atlantic division, and the absolute increase has been particularly marked since 1912—from 3,548,605,305 kilowatt hours in the last-named year to 7,659,317,763 in 1917. This division is followed at both periods in actual increase by the East North Central. The per cent of increase during the decade, however, has been most rapid, 784.1 per cent, in the East South Central division, followed by the South Atlantic with 555 per cent.

CENTRAL ELECTRIC STATIONS—OUTPUT OF GENERATING STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1917, 1912, AND 1907.

Table 50

DIVISION AND STATE.	KILOWATT HOURS GENERATED.				
	1917	1912	1907	Actual increase:[1] 1907–1917	Per cent of increase:[1] 1907–1917
UNITED STATES	25,438,303,272	11,569,109,885	5,862,276,737	19,576,026,535	333.9
GEOGRAPHIC DIVISIONS:					
New England	1,835,584,072	865,379,442	473,802,067	1,361,782,005	287.4
Middle Atlantic	7,659,317,763	3,548,605,305	2,009,304,160	5,650,013,603	281.2
East North Central	5,757,150,135	2,527,964,097	1,075,933,354	4,681,216,781	435.1
West North Central	1,776,475,523	712,595,442	380,180,647	1,396,294,876	360.0
South Atlantic	1,745,295,143	728,896,397	266,437,175	1,478,857,968	555.0
East South Central	1,048,814,771	227,664,808	118,631,967	930,182,804	784.1
West South Central	482,645,862	233,947,656	138,755,643	343,890,219	247.8
Mountain	2,036,194,737	845,393,882	381,032,187	1,655,162,550	434.4
Pacific	3,096,825,266	1,877,662,856	1,012,199,537	2,084,625,729	206.0
NEW ENGLAND:					
Maine	165,504,379	117,092,565	66,136,651	99,367,728	150.2
New Hampshire	160,456,223	126,593,970	55,258,921	105,197,302	190.4
Vermont	65,079,504	42,659,884	29,923,333	35,156,171	117.5
Massachusetts	937,124,653	386,254,294	219,425,607	717,699,046	327.1
Rhode Island	161,856,170	62,106,528	35,651,323	126,204,847	354.0
Connecticut	345,563,143	130,672,201	67,406,232	278,156,911	412.6
MIDDLE ATLANTIC:					
New York	3,828,592,181	2,175,048,634	1,452,222,471	2,376,369,710	163.6
New Jersey	781,230,790	383,891,504	140,527,522	640,703,268	455.9
Pennsylvania	3,049,494,792	989,665,167	416,554,167	2,632,940,625	632.1
EAST NORTH CENTRAL:					
Ohio	1,083,514,202	399,101,309	217,311,924	866,202,278	398.6
Indiana	441,423,385	230,044,000	130,263,693	311,159,692	238.9
Illinois	2,210,372,750	1,150,900,306	467,657,328	1,742,715,422	372.6
Michigan	1,504,230,843	525,615,508	208,154,199	1,296,085,644	622.6
Wisconsin	517,599,955	216,402,974	52,546,210	465,053,745	885.0
WEST NORTH CENTRAL:					
Minnesota	440,932,508	186,045,055	87,579,431	353,353,077	403.5
Iowa	614,808,584	67,166,647	37,729,072	577,079,512	1,529.5
Missouri	266,431,159	232,828,763	147,328,446	119,102,713	80.8
North Dakota	22,978,006	12,208,553	8,229,765	14,748,241	179.2
South Dakota	31,810,487	24,703,754	13,615,015	18,195,472	133.6
Nebraska	129,531,131	56,299,682	31,958,739	97,572,392	305.3
Kansas	269,983,648	133,252,988	59,740,179	210,243,469	351.9
SOUTH ATLANTIC:					
Delaware	3,359,280	3,412,319	4,714,074	−1,354,794	−28.7
Maryland[2]	182,407,826	28,629,117	47,868,675	134,539,151	281.1
District of Columbia	140,672,647	90,993,421	25,829,448	114,843,199	444.6
Virginia	107,580,758	28,724,684	10,208,360	97,372,398	953.8
West Virginia	204,107,945	42,344,796	24,871,317	179,236,628	720.6
North Carolina	371,711,733	70,552,737	13,171,681	358,540,052	2,722.1
South Carolina	500,430,903	356,771,757	68,696,424	431,734,479	628.5
Georgia	184,136,059	87,571,815	59,311,202	124,824,857	210.4
Florida	50,887,992	25,895,751	11,765,994	39,121,998	332.5
EAST SOUTH CENTRAL:					
Kentucky	122,630,433	75,593,179	37,232,623	85,397,810	229.4
Tennessee	564,914,272	75,544,893	34,847,956	530,066,316	1,521.1
Alabama	330,771,965	48,602,553	30,846,764	299,925,201	972.3
Mississippi	30,498,101	27,924,183	15,704,624	14,793,477	94.2
WEST SOUTH CENTRAL:					
Arkansas	38,644,801	17,786,660	11,519,316	27,125,485	235.5
Louisiana[3]	26,009,144	18,328,080	26,421,316	−412,172	−1.6
Oklahoma	100,737,632	48,824,097	24,985,903	75,751,729	303.2
Texas	317,254,285	149,008,819	75,829,108	241,425,177	318.4
MOUNTAIN:					
Montana	965,453,777	379,212,617	137,379,261	828,074,516	602.8
Idaho	145,307,596	115,812,292	9,577,588	135,730,008	1,417.2
Wyoming	27,391,551	11,580,567	5,499,084	21,892,467	398.1
Colorado	274,223,978	165,196,068	123,275,212	150,948,766	122.4
New Mexico	17,244,768	9,027,824	4,614,349	12,630,419	273.7
Arizona	65,731,753	32,960,084	9,392,302	56,339,451	599.8
Utah	486,995,136	86,634,658	61,672,661	425,322,475	689.6
Nevada	53,846,178	44,969,772	29,621,730	24,224,448	81.8
PACIFIC:					
Washington[3]	242,370,956	71,414,473	257,785,236	−15,414,280	−6.0
Oregon[3]	107,886,973	58,789,342	92,807,992	15,078,981	16.2
California	2,746,567,337	1,747,459,041	661,606,309	2,084,961,028	315.1

[1] A minus sign (−) denotes decrease.
[2] The decrease from 1907 to 1912 is due to the fact that one of the largest companies in Maryland, which generated the current used in 1907, purchased from outside the state most of that used in 1912.
[3] The decrease from 1907 to 1912 is due to the fact that companies which were included among the central stations in 1907 have since that date been taken over by the railways and included with them in the report for the electric railway industry in 1912.

Among the individual states, it may further be noted, the most rapid rate of growth (2,722.1 per cent) is to be found in North Carolina, which had very little electric service in 1907; in Iowa (1,529.5 per cent), in Tennessee (1,521.1 per cent), and in Idaho (1,417.2 per cent). The greatest actual in-

creases have, to be sure, taken place in the more important industrial states, of which Pennsylvania heads the list for the decade, with 2,632,940,625 kilowatt hours. New York is a close second, with 2,376,369,710 kilowatt hours. These are followed by California (2,084,961,028), Illinois (1,742,715,422), and Michigan (1,296,085,644). No others show a gain as high as 1,000,000,000 kilowatt hours. During the period 1912 to 1917 the greatest actual growth is found in Pennsylvania, where it amounts to more than 2,000,000,000 kilowatt hours. Then come New York, Illinois, California, and Michigan, the first of which shows an increase of nearly one and two-thirds billions and the second a little more than 1,000,000,000, while the other two report increases close to 1,000,000,000.

COMMERCIAL CENTRAL ELECTRIC STATIONS—OUTPUT OF GENERATING STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1917, 1912, AND 1907.

Table 51

DIVISION AND STATE.	KILOWATT HOURS GENERATED.				
	1917	1912	1907	Actual increase:[1] 1907–1917	Per cent of increase:[1] 1907–1917
UNITED STATES	24,398,983,183	11,031,583,155	5,572,813,949	18,826,169,234	337.8
GEOGRAPHIC DIVISIONS:					
New England	1,776,289,676	826,143,047	450,903,003	1,325,386,673	293.9
Middle Atlantic	7,618,282,163	3,519,216,083	1,983,341,586	5,634,890,577	284.1
East North Central	5,348,721,569	2,280,324,043	960,308,248	4,388,413,321	457.0
West North Central	1,623,567,900	650,807,731	342,800,564	1,280,767,336	373.6
South Atlantic	1,669,198,197	680,571,054	236,136,778	1,433,061,419	606.9
East South Central	1,012,378,561	195,999,962	97,074,576	915,303,985	942.9
West South Central	441,694,042	211,050,496	125,947,056	315,746,986	250.7
Mountain	2,017,305,528	836,590,469	375,815,364	1,641,490,164	436.8
Pacific	2,891,595,547	1,830,820,270	1,000,486,774	1,891,108,773	189.0
NEW ENGLAND:					
Maine	162,930,638	115,034,805	64,200,146	98,730,492	153.8
New Hampshire	159,067,555	126,129,170	54,463,809	105,513,746	193.8
Vermont	58,472,054	38,742,885	26,160,343	32,311,211	123.5
Massachusetts	893,857,242	358,503,754	206,383,440	687,473,802	333.1
Rhode Island	161,856,170	61,991,961	35,505,323	126,350,847	355.9
Connecticut	339,206,017	125,680,472	64,199,442	275,006,575	428.4
MIDDLE ATLANTIC:					
New York	3,809,608,046	2,160,064,465	1,441,317,340	2,368,290,706	164.3
New Jersey	776,086,559	381,674,327	139,357,377	636,729,182	456.9
Pennsylvania	3,032,537,558	977,477,291	402,666,869	2,629,870,689	653.1
EAST NORTH CENTRAL:					
Ohio	977,013,080	359,821,051	188,017,835	788,995,245	419.6
Indiana	381,527,002	205,722,726	106,317,599	275,209,403	258.9
Illinois	2,057,481,869	1,047,003,985	439,685,765	1,617,796,104	367.9
Michigan	1,432,636,234	461,111,350	178,698,930	1,253,937,304	701.7
Wisconsin	500,063,384	206,664,931	47,588,119	452,475,265	950.8
WEST NORTH CENTRAL:					
Minnesota	414,943,283	170,985,436	75,441,141	339,502,142	450.0
Iowa	593,887,643	57,191,263	30,387,174	563,500,469	1,854.4
Missouri	241,267,502	219,381,412	135,838,680	105,428,822	77.6
North Dakota	21,081,058	10,766,533	7,210,255	13,870,803	192.4
South Dakota	27,832,178	23,537,072	12,584,691	15,247,487	121.2
Nebraska	108,214,890	47,765,962	28,269,376	79,945,514	282.8
Kansas	216,341,346	121,240,053	53,069,247	163,272,099	307.7
SOUTH ATLANTIC:					
Delaware	2,475,900	2,255,400	3,539,139	−1,063,239	−30.0
Maryland[2]	176,422,138	20,575,129	45,558,955	130,863,183	287.2
District of Columbia	140,672,647	90,993,421	25,829,448	114,843,199	444.6
Virginia	95,651,186	20,564,230	7,799,819	87,851,367	1,126.3
West Virginia	202,260,794	40,905,654	23,157,102	179,103,692	773.4
North Carolina	358,027,715	63,898,206	8,086,074	349,941,641	4,327.7
South Carolina	495,531,481	353,704,032	66,654,585	428,876,896	643.4
Georgia	170,388,011	75,270,055	51,152,893	119,235,118	233.1
Florida	27,768,325	12,404,867	4,358,763	23,409,562	537.1
EAST SOUTH CENTRAL:					
Kentucky	112,274,252	65,882,463	33,113,858	79,160,394	239.1
Tennessee	552,841,201	65,773,123	27,493,009	525,348,192	1,910.8
Alabama	326,525,108	43,320,030	27,908,886	298,616,222	1,070.0
Mississippi	20,738,000	21,024,346	8,558,823	12,179,177	142.3
WEST SOUTH CENTRAL:					
Arkansas	32,784,841	13,791,366	9,240,827	23,544,014	254.8
Louisiana[3]	15,313,868	13,851,237	22,433,161	−7,119,293	−31.7
Oklahoma	86,984,421	42,590,541	23,057,560	63,926,861	277.2
Texas	306,610,912	140,817,352	71,215,508	235,395,404	330.5
MOUNTAIN:					
Montana	962,621,539	377,172,532	137,066,091	825,555,448	602.3
Idaho	142,290,046	114,882,022	9,030,453	133,259,593	1,475.7
Wyoming	26,897,243	11,463,667	5,499,084	21,398,159	389.1
Colorado	271,013,524	163,855,226	122,766,944	148,246,580	120.8
New Mexico	15,891,972	8,513,344	4,614,349	11,277,623	244.4
Arizona	65,630,864	32,960,084	9,392,302	56,238,562	598.8
Utah	479,114,162	82,773,822	57,824,411	421,289,751	728.6
Nevada	53,846,178	44,909,772	29,621,730	24,224,448	81.8
PACIFIC:					
Washington[3]	128,883,821	37,107,773	250,685,581	−131,801,760	−52.6
Oregon[3]	101,502,249	55,194,216	92,035,297	9,466,952	10.3
California	2,671,209,477	1,738,518,281	657,765,896	2,013,443,581	306.1

[1] A minus sign (−) denotes decrease.

[2] The decrease from 1907 to 1912 is due to the fact that one of the largest companies in Maryland, which generated the current used in 1907, purchased from outside the state most of that used in 1912.

[3] The decrease from 1907 to 1912 is due to the fact that companies which were included among the central stations in 1907 have since that date been taken over by the railways and included with them in the report for the electric railway industry in 1912.

The apparent decrease in output between different periods, together with certain discrepancies which occur in connection with the states of Delaware, Maryland, Louisiana, Washington, and Oregon, are usually accounted for by the fact that some companies which reported separately at earlier dates have for later periods been combined with electric railways in such a manner as to preclude the securing of a separate report satisfactory for census purposes. In some cases, also, it happens that a given station which formerly generated a considerable quantity of current now purchases a portion or all of its output from a plant located in another state. Accordingly, while for any of these reasons there would be a decrease or a less rapid rate of increase in the number of kilowatt hours reported as generated, it should, of course, be understood that there has been an actual increase in the amount of electric current used per capita.

MUNICIPAL CENTRAL ELECTRIC STATIONS—OUTPUT OF GENERATING STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1917, 1912, AND 1907.

Table 52

DIVISION AND STATE.	KILOWATT HOURS GENERATED.				
	1917	1912	1907	Actual increase:[1] 1907–1917	Per cent of increase:[1] 1907–1917
UNITED STATES	1,089,320,089	537,526,730	289,462,788	749,857,301	259.1
GEOGRAPHIC DIVISIONS:					
New England	59,294,396	39,236,395	22,899,064	36,395,332	158.9
Middle Atlantic	41,085,600	29,389,222	25,962,574	15,123,026	58.3
East North Central	408,428,566	247,640,054	115,625,106	292,803,460	253.2
West North Central	152,907,623	61,727,711	43,380,083	109,527,540	252.5
South Atlantic	76,096,946	49,325,343	30,300,397	45,796,549	151.1
East South Central	36,436,210	31,664,846	21,557,391	14,878,819	69.0
West South Central	40,951,320	22,897,160	12,808,587	28,143,233	219.7
Mountain	18,889,209	8,803,413	5,216,823	13,672,386	262.1
Pacific	205,229,719	46,842,586	11,712,763	193,516,956	1,652.2
NEW ENGLAND:					
Maine	2,573,741	2,057,760	1,936,505	637,236	32.9
New Hampshire	488,668	464,800	805,112	−316,444	−39.3
Vermont	6,607,450	3,916,999	3,762,490	2,844,960	75.6
Massachusetts	43,267,411	27,690,540	13,042,167	30,225,244	231.8
Rhode Island	[2]	114,567	146,000	−146,000	
Connecticut	6,357,126	4,991,729	3,206,790	3,150,336	98.2
MIDDLE ATLANTIC:					
New York	18,984,135	14,984,169	10,905,131	8,079,004	74.1
New Jersey	5,144,231	2,217,177	1,170,145	3,974,086	339.6
Pennsylvania	16,957,234	12,187,876	13,887,298	3,069,936	22.1
EAST NORTH CENTRAL:					
Ohio	106,501,122	39,280,258	20,294,089	77,207,033	263.6
Indiana	59,896,383	31,221,274	23,946,094	35,950,289	150.1
Illinois	152,800,881	103,896,321	27,971,563	124,919,318	446.6
Michigan	71,603,609	64,504,158	29,455,269	42,148,340	143.1
Wisconsin	17,536,571	8,738,043	4,958,091	12,578,480	253.7
WEST NORTH CENTRAL:					
Minnesota	25,989,225	15,059,619	12,138,290	13,850,935	114.1
Iowa	20,920,941	9,975,384	7,341,898	13,579,043	185.0
Missouri	25,103,657	13,447,351	11,489,766	13,613,891	119.0
North Dakota	1,896,948	1,532,020	1,019,510	877,438	86.1
South Dakota	3,978,309	1,166,682	1,030,324	2,947,985	286.1
Nebraska	21,316,241	8,533,720	3,689,363	17,626,878	477.8
Kansas	53,042,302	12,012,035	6,670,932	46,971,370	704.1
SOUTH ATLANTIC:					
Delaware	883,380	1,156,919	1,174,935	−291,555	−24.8
Maryland	5,985,688	3,053,988	2,309,720	3,675,968	159.2
District of Columbia					
Virginia	11,929,572	8,160,454	2,408,541	9,521,031	395.3
West Virginia	1,847,151	1,439,142	1,714,215	132,936	7.8
North Carolina	13,684,018	6,654,471	5,085,607	8,598,411	169.1
South Carolina	4,899,422	3,067,725	2,041,839	2,857,583	140.0
Georgia	13,748,048	12,301,760	8,158,309	5,589,739	68.5
Florida	23,119,667	13,490,884	7,407,231	15,712,436	212.1
EAST SOUTH CENTRAL:					
Kentucky	10,356,181	9,710,716	4,118,765	6,237,416	151.4
Tennessee	12,073,071	9,771,770	7,354,947	4,718,124	64.1
Alabama	4,246,857	5,282,523	2,937,878	1,308,979	44.6
Mississippi	9,760,101	6,899,837	7,145,801	2,614,300	36.6
WEST SOUTH CENTRAL:					
Arkansas	5,859,960	3,995,294	2,278,489	3,581,471	157.2
Louisiana	10,695,276	4,476,843	3,988,155	6,707,121	168.2
Oklahoma	13,753,211	6,233,556	1,928,343	11,824,868	613.2
Texas	10,643,373	8,191,467	4,613,600	6,029,773	130.7
MOUNTAIN:					
Montana	2,832,238	2,040,085	313,170	2,519,068	804.4
Idaho	3,017,550	930,270	547,135	2,470,415	451.5
Wyoming	494,308	116,900		494,308	
Colorado	3,210,454	1,340,842	508,268	2,702,186	531.6
New Mexico	1,352,796	514,480		1,352,796	
Arizona	100,889			100,889	
Utah	7,880,974	3,860,830	3,848,250	4,032,724	104.8
Nevada					
PACIFIC:					
Washington	123,487,135	34,306,700	7,099,655	116,387,480	1,639.3
Oregon	6,384,724	3,595,126	772,695	5,612,029	726.3
California	75,357,860	8,940,760	3,840,413	71,517,447	1,862.2

[1] A minus sign (−) denotes decrease.

[2] None reported in 1917.

DIAGRAM 10.—KILOWATT HOURS GENERATED, BY GEOGRAPHIC DIVISIONS: 1917, 1912, AND 1907.

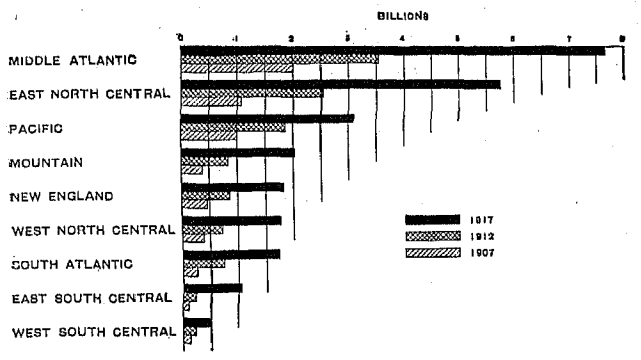
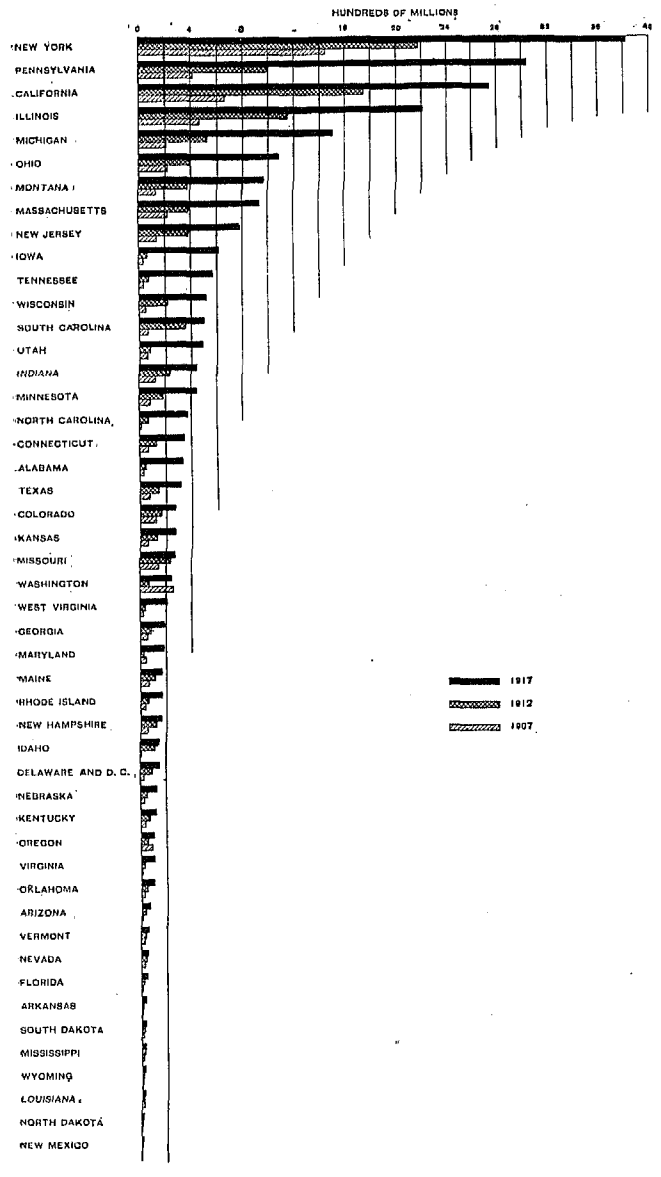


DIAGRAM 11.—KILOWATT HOURS GENERATED, BY STATES: 1917, 1912, AND 1907.



Since the number of kilowatt hours generated by commercial stations was so far in excess of that produced by municipal plants, no separate mention of the data for this group seems to be necessary, as practically all the statements which have been made regarding the combined output for all plants in the United States are also true for commercial plants. It may not, however, be amiss to call attention to some of the figures in connection with municipal plants. The East North Central division reported 408,428,566 kilowatt hours, or almost 40 per cent of the total number of kilowatt hours generated by all municipal plants, and this division has also shown the greatest actual increase since 1907 (292,803,460). The Pacific division was next in importance, with 205,229,719 kilowatt hours generated, followed by the West North Central, in which municipal plants generated 152,907,623 kilowatt hours. The increase during the past five years in actual amount of current generated by municipal plants in the East North Central and the Pacific divisions has been about the same, practically 160,000,000 kilowatt hours, no other division showing any particularly marked changes during the five-year period except the West North Central, in which municipal plants generated about 90,000,000 more kilowatt hours in 1917 than in 1912. The greatest relative increase during the decade is to be found in the Pacific division (1,652.2 per cent). Upon examining the various states it is found that Illinois in 1917 led in number of kilowatt hours generated by municipal plants (152,890,881). In Washington and Ohio, also, the number of kilowatt hours generated by this group was more than 100,000,000 (123,487,135 and 106,501,122, respectively). California (75,357,860), Michigan (71,603,609), Indiana (59,896,383), Kansas (53,642,302), and Massachusetts (43,267,411) complete the list of states in which any considerable quantity of current was generated by municipal plants.

Purchased current.—As the number of large generating stations has increased, and as it is becoming an easier matter to transmit current long distances over high-tension lines, there has normally been an increasing tendency for small plants to discard their generating equipment and purchase current from the larger and more economically operated stations. Many new stations also are now being installed of which the sole function is to distribute to customers the current produced by others. In this respect there is usually a decided gain when water power is used in place of fuel. Theoretically, it would be from the economic point of view highly desirable to have a comparatively few large generating stations which would be sufficient to supply all electricity needed, even though in many cases local companies might aid in the distribution of the current. Thus unnecessary

duplication of plants and equipment would be avoided. During the past five years, however, as has been previously suggested, the enormous expense involved in extending overhead construction to remote places has rather effectively retarded the growth which might otherwise have taken place in this phase of the industry.

Table 53 CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—KILOWATT HOURS PURCHASED, BY GEOGRAPHIC DIVISIONS: 1917 AND 1912.

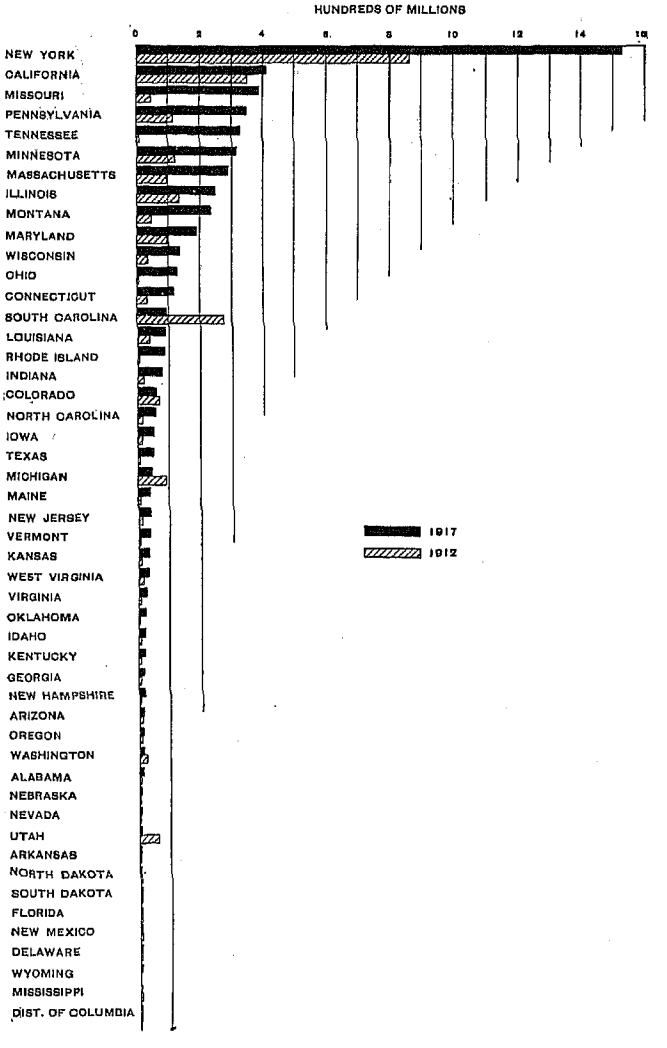
DIVISION.[1]	Census year.	Total.	Central electric stations.	Electric railways.
United States	1917	10,553,094,004	5,605,745,962	4,947,348,042
	1912	5,630,861,358	2,613,502,605	3,017,358,753
New England	1917	771,186,984	578,110,859	193,076,125
	1912	232,382,012	136,821,236	95,560,776
Middle Atlantic	1917	3,550,175,198	1,917,380,779	1,632,794,419
	1912	1,884,722,386	989,404,314	895,318,072
East North Central	1917	2,046,026,703	615,605,822	1,430,420,881
	1912	1,073,512,511	276,742,512	796,769,999
West North Central	1917	1,066,035,177	790,508,038	275,527,139
	1912	383,167,448	183,535,438	199,632,010
South Atlantic	1917	839,201,940	416,165,234	423,036,706
	1912	706,663,959	407,716,658	298,947,301
East South Central	1917	563,459,551	355,590,851	207,868,700
	1912	57,811,414	15,948,772	41,862,642
West South Central	1917	228,053,605	157,603,725	70,449,880
	1912	92,487,788	38,763,468	53,724,320
Mountain	1917	420,967,558	338,811,725	82,155,833
	1912	259,796,097	188,201,530	71,594,567
Pacific	1917	1,067,927,288	435,968,929	631,958,359
	1912	940,317,743	376,368,077	563,949,666

[1] See p. 18 for states composing the several geographic divisions.

The Census Bureau did not call for a separate return of the amount of current purchased by central stations and electric railways until 1912. Between that year and 1917, however, the total amount of current purchased by both central stations and electric railways, as shown in Table 53, has almost doubled, increasing from 5,630,861,358 kilowatt hours in 1912 to 10,553,094,004 kilowatt hours in 1917. The actual increase, as well as the rate of increase, has been much greater for central stations than for electric railways, the relative increase amounting to 114.5 per cent for the former and only 64 per cent for the latter. The relation which the amount of current purchased bears to the total output of plants has remained practically unchanged for central stations (18.4 per cent in 1912 and 18.1 per cent in 1917), while the relative amount of current purchased has increased for electric railways from 33.5 per cent to 40.6 per cent.

So far as the different divisions are concerned, the electric railways have experienced the greatest growth in actual quantity of current purchased in the Middle Atlantic and the East North Central, these two divisions together reporting almost three-fourths of the total increase for the United States. For central electric stations the greatest actual increase in number of kilowatt hours purchased is found in the Middle Atlantic division, where it is not far from 1,000,000,000 kilowatt hours. This is followed by the West North Central, with an increase of more than 600,000,000 kilowatt hours, and the New England division, with about 440,000,000. As compared with the total output of stations in the different divisions—that is, with the total amount of current generated and purchased—it appears that the highest relative amount of current purchased, 30.8 per cent, is found in the West North Central division. This is followed by the East South Central, the West South Central, and the New England divisions, all of which report purchased current to the extent of about 25 per cent of their total output. The lowest percentages are met with in the East North Central states (9.7) and in the Pacific division (12.3).

DIAGRAM 12.—PURCHASED CURRENT, KILOWATT HOURS, BY STATES: 1917.



In Table 54 is shown the number and output of all stations, both commercial and municipal, classified according to whether they generate or purchase all of their current, as well as according to the proportion generated or purchased in excess of 50 per cent of the total output but under 100 per cent.

Table 54 CENTRAL ELECTRIC STATIONS—CLASSIFICATION OF COMMERCIAL AND MUNICIPAL STATIONS ACCORDING TO PROPORTION OF CURRENT GENERATED AND PURCHASED: 1917 AND 1912.

	Census year.	Stations generating— All current.		Stations generating— 50 per cent but under 100 per cent.			Stations purchasing— All current.		Stations purchasing— 50 per cent but under 100 per cent.		
		Number of stations.	Number of kilowatt hours generated.	Number of stations.	Number of kilowatt hours generated.	Number of kilowatt hours purchased.	Number of stations.	Number of kilowatt hours purchased.	Number of stations.	Number of kilowatt hours generated.	Number of kilowatt hours purchased.
Total	1917	4,556	7,179,459,175	355	17,121,115,660	1,801,805,635	1,418	1,236,670,848	213	1,137,728,437	2,567,269,479
	1912	4,348	6,398,615,487	211	5,010,805,110	542,099,262	575	1,269,918,982	87	159,689,288	801,484,361
Commercial	1917	2,887	6,306,496,189	288	16,959,607,958	1,794,905,303	877	1,074,545,276	172	1,132,879,036	2,543,756,984
	1912	2,962	5,908,791,606	180	4,967,072,784	539,259,526	439	1,207,304,288	78	155,718,765	778,358,414
Municipal	1917	1,669	872,962,986	67	161,507,702	6,900,332	541	162,125,572	41	4,849,401	23,512,495
	1912	1,386	489,823,881	31	43,732,326	2,839,736	136	62,614,694	9	3,970,523	23,125,947
PER CENT OF INCREASE.[1]											
Total		4.8	12.2	68.2	241.7	232.4	146.6	—2.6	144.8	612.5	220.3
Commercial		—2.5	6.7	60.0	241.4	232.8	99.8	—11.0	120.5	627.5	226.8
Municipal		20.4	78.2	116.1	269.3	143.0	297.8	158.9	355.6	22.1	1.7
PER CENT DISTRIBUTION.											
Total	1917	69.6	28.2	5.4	67.3	32.1	21.7	22.1	3.3	4.5	45.8
	1912	83.3	55.3	4.0	43.3	20.7	11.0	48.6	1.7	1.4	30.7
Commercial	1917	68.3	25.8	6.8	69.5	33.2	20.3	19.8	4.1	4.6	47.0
	1912	81.0	53.6	4.9	45.0	21.4	12.0	47.8	2.1	1.4	30.8
Municipal	1917	72.0	84.0	2.9	15.5	3.6	23.3	84.2	1.8	0.5	12.2
	1912	88.7	91.1	2.0	8.1	3.2	8.7	70.7	0.6	0.7	26.1
AVERAGE OUTPUT PER STATION.											
Total	1917	.....	1,575,825	.....	48,228,495	5,075,509	.....	872,123	.....	5,341,448	12,052,908
	1912	.....	1,471,623	.....	23,747,892	2,569,191	.....	2,208,555	.....	1,835,509	9,212,464
Commercial	1917	.....	2,184,446	.....	58,887,528	6,232,310	.....	1,225,251	.....	6,586,506	14,789,285
	1912	.....	1,994,865	.....	27,594,849	2,995,886	.....	2,750,124	.....	1,996,394	9,978,954
Municipal	1917	.....	523,046	.....	2,410,563	102,990	.....	299,678	.....	118,278	573,475
	1912	.....	353,408	.....	1,410,720	91,604	.....	460,402	.....	441,169	2,569,550

[1] A minus sign (—) denotes decrease.

It is interesting to find that the group of plants *generating* all current has increased but little, either in number or in output, since 1912, the percentage of increase being 4.8 and 12.2, respectively. In this group, also, there has been an actual decrease of 2.5 per cent in number of commercial plants, from 2,962 in 1912 to 2,887 in 1917, whereas municipal plants have shown an increase of 20.4 per cent during the same period, combined with a growth of 78.2 per cent in number of kilowatt hours generated. Those plants purchasing all current have shown by far the greatest actual increase in number, 843, though for commercial and municipal stations combined there has been a decrease of 2.6 per cent in output. This decrease, however, is caused solely by the conditions found in the group of commercial plants. Three very large commercial stations in the state of New York which, in 1912, purchased all of their current were, in 1917, as a result of certain combinations, generating as well as purchasing current. One of these stations is included in the group which generated "50 per cent but under 100 per cent" of the total output, and two in the group which purchased "50 per cent but under 100 per cent" of the total output. Municipal plants purchasing all current reported a large and wholly consistent increase both in number of stations and in output. Plants generating "50 per cent but under 100 per cent" of their total output formed a very small proportion of the total number of stations (5.4 per cent), but generated about two-thirds of all current. The relative increase in the amount of current generated by this group has been 241.7 per cent since 1912, and the increase in the number of kilowatt hours which they purchased has been almost equally rapid. The group purchasing "50 per cent but under 100 per cent" has been subject to the most rapid rate of increase in the number of kilowatt hours generated, from 159,689,288 in 1912 to 1,137,728,437 in 1917, or 612.5 per cent, though in number they were least important and they ranked next to the lowest in total output. The actual increase in number of kilowatt hours purchased by this group, from 801,484,361 to 2,567,269,479, has been higher than in any other. It must be mentioned, however, that practically all the changes are accounted for by commercial plants. Municipal plants in this group, while increasing considerably in numbers, have shown almost no change either in the quantity of current generated or purchased.

Perhaps some further mention should be made of the relative quantities of current generated or purchased by the several groups as classified in Table 54. It appears, accordingly, that both for commercial and municipal plants the proportion which generated all current has decreased since 1912, until at the later date the percentage distribution of this group for both classes of plants was about the same, 68.3 and 72 per cent, respectively. In number of kilowatt hours generated, however, this class of commercial plants reported only 25.8 per cent of all current produced by

them, whereas the municipal stations reported 84 per cent. On the other hand, municipal plants in the group generating "50 per cent but under 100 per cent" of their total output were relatively negligible in number and output, but the corresponding commercial plants generated 69.5 per cent of the total current produced by all commercial plants and purchased 33.2 per cent of the total number of kilowatt hours purchased. It is further interesting to find that a relatively small proportion of the total current purchased by commercial plants, 19.8 per cent, was bought by that group which generated no current, whereas 84.2 per cent of all current purchased by municipal plants was reported in this group.

The average output of stations, according to the above classification, has been subject to highly significant changes. No doubt some will be surprised to find that the number of kilowatt hours generated per plant producing all current has increased so little during the past five years, about 7 per cent. However, the increase in the case of municipal plants has been more marked, nearly 50 per cent. In 1917 commercial plants in this group averaged 2,184,446 kilowatt hours per station and municipal plants 523,046. The averages for the group which generated between 50 and 100 per cent of the total output were overwhelmingly greater than the averages for any other group. In fact, the total output, including both current generated and purchased, was more than 65,000,000 kilowatt hours per plant for commercial stations and more than 2,500,000 kilowatt hours for municipal stations. Those municipal plants which purchased between 50 and 100 per cent of their total output have decreased very rapidly in size since 1912, while the corresponding commercial stations have grown from an average combined output of nearly 12,000,000 kilowatt hours in 1912 to an output of more than 21,000,000 kilowatt hours in 1917. Finally, the decrease in average output of those stations which purchased all current is very marked—from 2,750,124 to 1,225,251 kilowatt hours for commercial stations and from 460,402 to 299,678 kilowatt hours for municipal plants. This decrease in the case of commercial plants has been occasioned in no small degree by the fact that some of the largest plants reporting in this group in 1912 have since been absorbed by other plants which generate some current. The tendency, however, toward an increase in number of small purchasing plants is sufficiently evident and is a result not only of the installation of new plants, but is also due to the dismantling of many smaller and uneconomically operated stations which formerly produced current.

Table 55 shows for geographic divisions, for 1917 and 1912, the distribution of plants according to the classification already used in Table 54. A few of the facts herein disclosed merit attention. In the New England, Middle Atlantic, East North Central, and Pacific divisions there has been a very notable decrease in the number of plants which generate all current, while the only conspicuous increase in number for this group has been in the West North Central division. Every division, on the other hand, has witnessed an increase in the number which generated between 50 and 100 per cent of their current as well as in the number which purchased either all current or between 50 and 100 per cent of their output. Both those plants which generated and which purchased all current were by far the most numerous in the East North Central and the West North Central divisions, which combined reported, in 1917, 48.9 and 46.9 per cent, respectively, of the total number of all plants in these groups. The Middle Atlantic, East North Central, and West North Central divisions reported the greatest increases in the number of commercial plants purchasing all current, while for municipal plants the greatest increases were in the East North Central and West North Central divisions. So far as the output is concerned, commercial plants generating all current reported a decrease in quantity in five divisions—the New England, Middle Atlantic, West North Central, South Atlantic, and Mountain. In the last three divisions mentioned this decrease in quantity of current generated (37.5 per cent, 21.3 per cent, and 32.2 per cent, respectively) has been accompanied by a considerable increase in the number of stations (22.3 per cent, 13.6 per cent, and 16.7 per cent, respectively). These changes, of course, indicate an unexpected increase in the number of smaller generating stations in the sections under consideration. The really large commercial generating plants appear to be found in practically every division under the group which produced between 50 and 100 per cent of the total output. Municipal plants which generated all current have shown an increase in output in all divisions in spite of the decrease in number of stations which has occurred in some divisions. Among plants purchasing all current there has been in every case an increase in output for municipal stations. There has also been an increase in all divisions for the corresponding commercial plants, with the exception of the Middle Atlantic, which reported in 1917 almost 40 per cent of the total output for this group. The almost 50 per cent decrease in output for this division (from 781,767,031 in 1912 to 420,533,674 in 1917) has already been explained as being caused by certain changes in several very large New York plants.

Finally, it is interesting to note that the largest average output for commercial stations generating all current in 1917 is to be found in the Middle Atlantic and the Pacific divisions, though in the former the size is much greater than in the latter (almost 8,000,000 kilowatt hours as opposed to somewhat more than 4,000,000). The largest commercial plants generating more than 50 per cent of their current are to be found in the Mountain and the Pacific divisions, the average

amount generated by each of these divisions being more than 100,000,000 kilowatt hours per plant. The municipal generating plants average largest in output in the Pacific division, followed by the New England and the East North Central. The lowest average for commercial plants which generated all current was reported by the West North Central division, in which the average output was less than 500,000 kilowatt hours per plant, and the lowest average for municipal plants in the same group was reported by the West South Central division, in which the average was about 228,000.

CENTRAL ELECTRIC STATIONS—NUMBER AND OUTPUT OF COMMERCIAL AND MUNICIPAL STATIONS, CLASSIFIED ACCORDING TO PROPORTION OF CURRENT GENERATED AND PURCHASED: 1917 AND 1912.

Table 55

DIVISION.	Census year.	STATIONS GENERATING— All current. Number of stations.	STATIONS GENERATING— All current. Number of kilowatt hours generated.	STATIONS GENERATING— 50 per cent but under 100 per cent. Number of stations.	STATIONS GENERATING— 50 per cent but under 100 per cent. Number of kilowatt hours generated.	STATIONS GENERATING— 50 per cent but under 100 per cent. Number of kilowatt hours purchased.	STATIONS PURCHASING— All current. Number of stations.	STATIONS PURCHASING— All current. Number of kilowatt hours purchased.	STATIONS PURCHASING— 50 per cent but under 100 per cent. Number of stations.	STATIONS PURCHASING— 50 per cent but under 100 per cent. Number of kilowatt hours generated.	STATIONS PURCHASING— 50 per cent but under 100 per cent. Number of kilowatt hours purchased.
TOTAL.											
United States	1917	4,556	7,179,459,175	355	17,121,115,660	1,801,805,635	1,418	1,236,670,848	213	1,137,728,437	2,567,269,479
	1912	4,348	6,398,615,487	211	5,010,805,110	542,099,262	575	1,269,918,982	87	159,689,288	801,484,361
New England	1917	155	525,662,496	52	1,172,282,172	177,131,347	141	144,754,181	35	137,639,404	256,225,331
	1912	228	584,572,963	42	277,668,115	21,055,915	85	98,468,204	13	3,138,364	16,697,117
Middle Atlantic	1917	361	2,243,291,006	68	5,062,154,240	483,170,427	202	430,451,842	48	353,872,517	1,003,758,510
	1912	489	2,314,183,960	41	1,214,247,975	99,555,870	111	783,105,328	28	20,173,370	106,743,116
East North Central	1917	936	1,778,552,888	82	3,946,803,177	236,481,084	324	267,389,624	43	31,794,070	111,735,114
	1912	1,085	1,106,482,688	46	1,410,682,647	73,184,158	116	170,132,494	13	10,798,762	33,425,860
West North Central	1917	1,290	500,757,667	61	1,103,009,532	144,475,262	341	153,162,909	38	172,708,324	492,869,367
	1912	991	627,485,575	15	62,675,243	9,561,090	64	112,164,613	7	22,434,624	61,809,735
South Atlantic	1917	519	462,026,241	24	1,110,935,361	137,040,946	170	69,527,318	15	172,333,541	209,596,970
	1912	427	542,980,143	14	156,839,790	652,189	65	38,202,431	6	30,076,464	368,862,038
East South Central	1917	369	443,587,250	6	365,936,499	20,441,475	26	18,470,623	9	239,291,022	316,678,753
	1912	309	207,760,044	4	19,344,002	4,768,915	14	7,959,846	3	570,762	3,220,011
West South Central	1917	571	351,293,136	14	128,409,076	43,422,240	44	43,941,915	7	2,943,650	70,239,570
	1912	488	181,874,548	6	51,662,515	1,297,373	11	1,674,415	2	410,593	35,791,689
Mountain	1917	228	321,034,262	20	1,698,573,108	237,024,238	79	36,845,353	10	16,587,367	64,942,134
	1912	185	462,941,518	16	342,662,680	49,285,180	41	27,615,785	8	39,789,684	111,300,565
Pacific	1917	127	553,254,229	28	2,533,012,495	322,618,616	91	72,127,083	8	10,558,542	41,223,230
	1912	146	370,344,048	27	1,475,022,143	282,138,572	68	30,595,866	7	32,296,665	63,634,239
COMMERCIAL.											
United States	1917	2,887	6,306,496,189	288	16,959,607,958	1,794,905,303	877	1,074,545,276	172	1,132,879,036	2,543,756,984
	1912	2,962	5,908,791,606	180	4,967,072,784	539,269,526	439	1,207,304,288	78	155,718,765	778,358,414
New England	1917	128	476,312,193	47	1,165,343,388	176,187,750	107	135,425,710	29	134,634,095	245,812,676
	1912	195	550,462,129	36	272,681,554	19,966,491	68	94,893,001	12	2,999,364	16,531,117
Middle Atlantic	1917	280	2,205,097,262	59	5,059,762,690	482,657,702	174	420,533,674	43	353,372,211	1,003,038,965
	1912	399	2,285,044,271	39	1,214,037,757	99,541,255	102	781,767,031	27	20,134,055	106,662,236
East North Central	1917	520	1,389,244,908	66	3,937,078,357	235,801,562	199	197,237,840	33	31,398,214	107,203,428
	1912	654	864,751,068	37	1,405,274,082	72,758,578	86	135,477,620	9	10,298,893	30,256,658
West North Central	1917	757	354,416,614	42	1,096,577,451	142,738,181	141	136,269,850	30	172,573,835	491,072,759
	1912	619	567,437,268	10	60,995,839	9,362,068	42	109,120,292	7	22,434,624	61,809,735
South Atlantic	1917	203	388,716,270	18	1,108,519,705	136,796,505	79	39,885,454	8	171,962,222	205,032,896
	1912	258	493,982,640	11	156,511,950	537,406	33	25,555,820	6	30,076,464	368,862,038
East South Central	1917	224	407,361,372	6	365,936,499	20,441,475	19	17,391,411	7	239,080,690	315,653,901
	1912	185	176,321,208	3	19,107,902	4,766,415	11	7,664,531	3	570,762	3,220,011
West South Central	1917	302	310,433,516	14	128,409,076	43,422,240	33	40,357,001	6	2,851,450	69,939,570
	1912	370	159,033,637	5	51,628,255	1,282,373	9	859,127	1	388,604	35,146,130
Mountain	1917	182	307,883,580	14	1,692,936,581	236,847,223	59	33,204,041	9	16,485,367	64,837,659
	1912	156	454,329,021	14	342,471,764	49,109,668	33	26,004,972	8	39,789,684	111,300,565
Pacific	1917	111	476,030,384	22	2,405,044,211	320,012,665	66	54,240,295	7	10,520,952	41,165,130
	1912	126	357,430,274	25	1,444,363,681	281,935,272	55	25,961,894	5	29,026,315	44,569,024
MUNICIPAL.											
United States	1917	1,669	872,962,986	67	161,507,702	6,900,332	541	162,125,572	41	4,849,401	23,512,495
	1912	1,386	489,823,881	31	43,732,326	2,839,736	136	62,614,694	9	3,970,523	23,125,947
New England	1917	27	49,350,303	5	6,938,784	943,597	34	9,328,471	6	3,005,309	10,412,655
	1912	33	34,110,834	6	4,986,561	1,689,424	17	3,575,203	1	139,000	166,000
Middle Atlantic	1917	81	38,193,744	9	2,391,550	512,725	28	9,918,168	5	500,306	719,545
	1912	90	29,139,689	2	210,218	14,615	9	1,338,297	1	39,315	80,880
East North Central	1917	416	398,307,890	16	9,724,820	679,522	125	70,151,784	10	395,856	4,531,686
	1912	431	241,731,620	9	5,408,565	425,580	30	34,654,874	4	499,869	3,169,202
West North Central	1917	533	146,341,053	19	6,432,081	1,737,081	200	16,893,059	8	134,489	1,797,108
	1912	372	60,048,307	5	1,679,404	199,022	22	3,044,321			
South Atlantic	1917	226	73,309,971	6	2,415,656	244,441	91	29,641,864	7	371,319	4,564,074
	1912	169	48,997,503	3	327,840	114,783	32	12,646,611			
East South Central	1917	145	36,225,878				7	1,079,212	2	210,332	1,024,852
	1912	124	31,428,746	1	236,100	2,500	3	295,315			
West South Central	1917	179	40,859,620				11	3,584,914	1	92,200	300,000
	1912	118	22,840,911	1	34,260	15,000	2	815,288	1	21,989	645,550
Mountain	1917	46	13,150,682	6	5,636,527	177,015	20	3,641,312	1	102,000	104,475
	1912	29	8,612,497	2	190,916	175,512	8	1,610,813			
Pacific	1917	16	77,223,845	6	127,968,284	2,605,951	25	17,886,788	1	37,590	58,100
	1912	20	12,013,774	2	30,658,462	203,300	13	4,633,972	2	3,270,350	19,064,315

Disposal of current.—Table 56 combines in a convenient way comparative data regarding the output and disposal of current for commercial and municipal plants. From the data here given we find that the proportion which purchased current bears to the total output of stations has been somewhat smaller at both periods for municipal stations than for the other group.

In this connection mention should be made of the fact that not all of the current purchased by central stations is also generated by them, for a large though indeterminate quantity is sold to central stations by electric railways. It frequently happens, also, that current sold to one station is resold to another plant, so that there is bound to be a certain amount of duplication in the figures for purchased current, though only by considering all current, both generated and purchased by a plant, can we have a line on the extent of business done by that plant in relation to its customers.

Table 56 CENTRAL ELECTRIC STATIONS—TOTAL OUTPUT AND DISPOSAL OF CURRENT: 1917 AND 1912.

	Total.	Commercial.	Municipal.
Output:			
1917—			
Total	31,044,049,234	29,812,190,746	1,231,858,488
Kilowatt hours generated	25,438,303,272	24,398,983,183	1,039,320,089
Kilowatt hours purchased	5,605,745,962	5,413,207,563	192,538,399
1912—			
Total	14,182,612,490	13,556,505,383	626,107,107
Kilowatt hours generated	11,569,109,885	11,031,583,155	537,526,730
Kilowatt hours purchased	2,613,502,605	2,524,922,228	88,580,377
Per cent of total output:			
1917—			
Kilowatt hours generated	81.9	81.8	84.4
Kilowatt hours purchased	18.1	18.2	15.6
1912—			
Kilowatt hours generated	81.6	81.4	85.8
Kilowatt hours purchased	18.4	18.6	14.2
Disposal of current, 1917:			
For light	5,112,516,949	4,445,217,785	667,299,164
For power	13,174,827,277	12,833,191,106	341,636,171
To other public service corporations	7,464,620,574	7,444,108,488	20,512,086
Other purposes (nonrevenue)	831,473,947	821,522,389	9,951,558
Distribution and line losses	4,460,610,487	4,268,150,978	192,459,509
Average per plant—			
For light	781,491	1,052,372	287,877
For power	2,013,884	3,038,161	147,384
To other public service corporations	1,141,030	1,762,336	8,849
Other purposes (nonrevenue)	127,098	194,489	4,293
Distribution and line losses	681,842	1,010,452	83,028
Per cent of total output, 1917—			
For light	16.5	14.9	54.2
For power	42.4	43.0	27.7
To other public service corporations	24.0	25.0	1.7
Other purposes (nonrevenue)	2.7	2.8	0.8
Distribution and line losses	14.4	14.3	15.6

As no attempt was made before 1917 to secure data regarding the disposal of current for various purposes, a good deal of difficulty was encountered in securing satisfactory information from those smaller plants whose records were not systematically kept. The absence of station meters and frequently of customers' meters, in addition to careless keeping of records and absence of engineering training on the part of some managers, has no doubt led to some inaccuracy in specific cases. The utmost care, however, was exercised by the Census Bureau, all doubtful cases being checked through the proper channels, so that it is thought that the figures now assembled may be fairly accepted for census uses. At any rate, the more numerous though relatively unimportant errors arising in connection with the smaller stations would not be sufficient to have any appreciable effect upon totals, wherein the larger plants which keep satisfactory records greatly predominate. It may be said that in general much more difficulty was experienced in getting satisfactory answers from municipal plants in reply to this part of the schedule than from commercial stations.

Perhaps the reader's attention should be called to the fact that some stations selling current for power do not keep a separate record of the same, but include it with current sold for lighting purposes. As a result the amount of current reported by all plants as delivered for light is probably somewhat in excess of the actual amount so used. Under "current sold for power" it is probable that some plants mistakenly reported current which was furnished to street railways and which should accordingly have been entered under current sold "to other companies." It should be mentioned also that as there was not a separate item on the schedule for reporting current used "for heating purposes," an attempt was made to have current so used uniformly entered under "power." The fourth item under disposal of current, "all other purposes," presumably includes only that portion of the output which was used at the various stations for light, excitation, etc. Finally, the accuracy of the item "distribution and line losses" will, of course, depend upon the care with which the output is measured at the stations and on the customers' premises. Whenever, as is frequently the case in smaller plants, these data are largely estimates, some slight error will be unavoidable, though, as previously suggested, everything has been done to reduce such errors to the minimum.

A further examination of Table 56 shows how unimportant relatively was the business done by municipal plants. Only in current sold for lighting purposes was there any significant approach in size to the commercial stations. The average amount of current furnished per plant for light, including street lighting, was 1,052,372 kilowatt hours for the latter and 287,877 for the former. Commercial plants, however, sell for power more than twenty times as much current on the average as do municipal plants, while in the case of the latter the average sales of current to other public service corporations, 8,849 kilowatt hours, are utterly negligible.

Exactly what portion of the total amount of current sold to other public service corporations, 7,464,620,574 kilowatt hours, was furnished to central stations it is impossible to state. Probably, however, not far from three-fifths of this amount was so disposed of. In numerous instances a large distributing company will

purchase current in bulk from the company which generates it, passing it on in turn to other central stations. The remainder of the amount reported in answer to this inquiry went to street railways, which in turn sold a considerable quantity of current among themselves and furnished an additional though uncertain amount to central stations. Whatever apparent discrepancies there may be between the total number of kilowatt hours reported as purchased by central stations and street railways and the amount which seems to have been sold by them to some other public service corporations is, as just stated, mostly hidden under "power" sales.

Attention should be called to the percentage relations which the different items bear to the total output of stations for the two groups of plants. Accordingly, 54.2 per cent of the entire output of municipal plants went for lighting purposes, whereas little more than one-quarter as much, 14.9 per cent, was supplied for the same uses by commercial stations. The difference in the relative quantities of current supplied for power was far less marked, 43 per cent for commercial and 27.7 per cent for municipal plants. The former sold at least one-quarter of their entire output to other companies, including street railways, whereas the latter disposed of less than 2 per cent in this manner. The nonrevenue uses of current, while comparatively small in either case, were relatively much higher in commercial stations (2.8 as opposed to eight-tenths of 1 per cent). This is a condition which might be expected on account of the difference in size and nature of business carried on by most commercial stations, which not only use more current at the generating plants themselves, but also maintain large offices and numerous showrooms and advertising signs, all of which consume a large quantity of current for light. It is possible, also, that in some instances the requirements of this item were misinterpreted, and occasionally relatively small entries may have been made by large commercial stations doing many kinds of business which properly belonged with one of the other items, but for which there was no separate place on the schedule.

The per cent of distribution and line losses does not appear to be widely different for the two groups of plants, 14.3 per cent for commercial stations and 15.6 per cent for municipal stations. One or two qualifications, however, should be made. In the first place, an examination of the schedules disclosed the fact that municipalities in general were disposed to misinterpret or, at any rate, to underestimate the item of distribution and line losses. This was due largely to the fact that so many of this group of plants were not supplied with station meters, and, accordingly, estimated their total output on the basis of the current actually delivered to customers. As most of these plants are comparatively small and as their total output forms a small proportion of the total for both groups of stations, errors here made would show up more seriously than in the case of commercial plants. Accordingly, there is good reason to believe that the item "distribution and line losses" has been put at too low a figure for municipal plants. Among commercial stations, on the other hand, the larger plants keeping accurate records so greatly outweigh the smaller that any errors made in this respect will be negligible. When consideration is given, however, to the wide extent of territory served by the average commercial station, the total number of which, 4,224, supply current to 11,349 separate municipalities, and some of which serve more than 100 different places, it might be expected, other things being equal, that commercial stations would be subject to distribution and line losses relatively far greater than would be met with in the municipal plants, which, with a very few unimportant exceptions, serve only the municipalities in which they are located.

Final attention may also profitably be called to the proportion of current delivered for various purposes, estimated on the basis of the total amount of current sold instead of the total output. Table 57, accordingly, shows the relations which exist. Commercial stations sell 51.9 per cent for power, or more than one-half of the current which they actually deliver to customers, while 30.1 per cent is sold to other companies. Municipalities, on the other hand, furnish almost two-thirds of their current for light, including free service, while one-third goes for power, and only one-fiftieth to other companies.

Table 57 — PER CENT DISTRIBUTION OF CURRENT DELIVERED FOR VARIOUS PURPOSES: 1917.

	All stations.	Commercial.	Municipal.
Total	100.0	100.0	100.0
Light	19.8	18.0	64.8
Power	51.2	51.9	33.2
To other companies	29.0	30.1	2.0

In this place a few data of general interest may well be mentioned. In the group of commercial stations there were 1,742, or 41.2 per cent of the total, which sold no current for power. Municipal plants similarly reported in the same class 1,105 stations, or 47.7 per cent of the total. There are, again, 53 commercial plants selling current only for power or both for power and to other companies. Also, 42 commercial stations, with an output of 285,377,527 kilowatt hours, sell all their current to other companies. Again, 5 commercial plants and 67 municipal plants do only a street or park lighting business, while 7 other municipal plants do a combined street lighting and municipal power business. Finally, 822 stations, of which 710 are commercial and 112 municipal, sell current to other public service corporations.

Average output per plant according to population groups.—Before leaving this subject it will be worth while to make some attempt to show the average amount of current delivered for light and for power by commercial and municipal stations, arranged according to the population groups discussed in Chapter II (p. 37), together with the number of kilowatt hours consumed per capita for the different services. These data are summarized in Table 58.

Table 58 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS GROUPED ACCORDING TO POPULATION—AVERAGE PER PLANT AND PER CAPITA CONSUMPTION OF CURRENT FOR LIGHT AND POWER: 1917.

POPULATION GROUP.	Average per plant.			Kilowatt hours consumed per capita.	
	Population of districts served.	Kilowatt hours sold for light.	Kilowatt hours sold for power.	Light.	Power.
	TOTAL.				
All districts	9,696	787,858	1,939,595	81	200
Under 1,000	534	23,451	121,518	44	228
1,000 but under 2,000	1,266	65,024	138,988	51	110
2,000 but under 5,000	2,744	160,597	260,017	59	95
5,000 but under 10,000	5,845	302,456	628,119	67	107
10,000 but under 25,000	12,529	850,209	3,264,906	68	261
25,000 but under 50,000	26,102	1,928,652	5,228,392	74	200
50,000 but under 100,000	47,315	3,454,295	12,704,137	73	269
100,000 but under 200,000	104,092	6,669,312	18,900,461	64	182
200,000 but under 500,000	194,814	15,909,030	41,862,287	82	215
500,000 and over	324,611	33,966,567	67,842,555	105	209
	COMMERCIAL.				
All districts	13,536	1,065,719	2,935,601	79	217
Under 1,000	522	21,888	180,558	42	346
1,000 but under 2,000	1,279	62,836	230,591	49	180
2,000 but under 5,000	2,821	156,923	393,342	56	139
5,000 but under 10,000	6,184	370,431	898,734	60	145
10,000 but under 25,000	13,331	873,166	4,137,675	63	299
25,000 but under 50,000	28,072	1,997,638	5,992,850	71	213
50,000 but under 100,000	51,146	3,559,894	14,080,914	70	275
100,000 but under 200,000	105,864	6,775,658	20,185,050	64	191
200,000 but under 500,000	194,490	15,555,339	43,594,782	80	224
500,000 and over	370,170	35,804,295	76,307,555	97	206
	MUNICIPAL.				
All districts	5,898	287,877	147,384	49	25
Under 1,000	570	20,552	4,312	47	8
1,000 but under 2,000	1,317	67,930	17,339	52	13
2,000 but under 5,000	2,878	165,693	75,090	58	26
5,000 but under 10,000	6,318	427,008	202,867	68	32
10,000 but under 25,000	13,718	777,587	504,107	57	37
25,000 but under 50,000	34,610	1,535,176	868,150	44	25
50,000 but under 100,000	59,433	2,679,907	2,607,771	45	44
100,000 but under 200,000	129,203	5,552,682	5,412,276	43	42
200,000 but under 500,000	283,333	21,568,081	14,142,361	76	50
500,000 and over	593,618	20,872,754	7,529,434	35	13

Attention should first be called to the fact that the average population served per plant was similar for both classes of stations in all 5 groups serving less than 25,000 people. In these lower groups it is unusual to find a commercial and municipal plant operating in the same territory, nor does it often occur that more than one commercial station will be found in a given district of this size. Beyond this point, however—that is, in those groups serving from 25,000 population upward—municipal plants lead in every group in the average number of inhabitants served. The reason for this condition is evident. Municipal plants, as in the lower population groups, serve a single locality, and, with one or two exceptions, even in the larger places only one station is found in a given municipality. There are, however, frequently several commercial stations operating in the same territory, and in the case of those numerous companies which serve a large number of separate localities, this condition is even more common. It not infrequently happens that while one commercial station does the greater part of the electric light and power business in a given district, there may be several others whose output is delivered almost wholly for power used by large manufacturing concerns or sold largely in bulk to central stations. The former are, of course, always included in this tabulation, as well as the latter, if they incidentally sell some current for lighting or power purposes. By the inclusion of such plants the average population served by commercial stations in the higher groups is naturally somewhat reduced.

It is significant to find that in each population group up to 10,000 the average municipal plant supplies slightly more current for light than does the corresponding commercial plant, nor does the latter appear to have much advantage over the former until the highest group is reached. In the group between 200,000 and 500,000 population municipal plants are markedly in the lead. As just suggested, however, these averages for commercial stations are somewhat misleading, because a number of plants are included which sell no current for light (42), while many others do almost no lighting business. There is a total of 95 commercial stations which sell no current for light, 53 of which, for reasons earlier explained,[1] are omitted from this tabulation. The average amount of current sold for light by all commercial plants, 1,065,719 kilowatt hours, is almost four times as great as the average per municipal plant, 287,877 kilowatt hours.

Much more indicative of the true situation are the averages which show the number of kilowatt hours sold for power by population groups in the two classes. For both commercial and municipal plants there is a steady increase in the average power sales from the lowest to the highest group, except in the case of the highest group for municipal stations, for which the average was only about one-half that shown for the next highest group, but it is interesting to find that at every stage commercial stations are many hundred per cent in the lead. The average power sales for the commercial plants here tabulated are 2,935,601 kilowatt hours, or almost three times as great as their average light sales. For municipal plants, on the other hand, the average power sales were only 147,384 kilowatt hours, or about half the average light sales for the same group and only a little more than one-twentieth of the average power sales of commercial

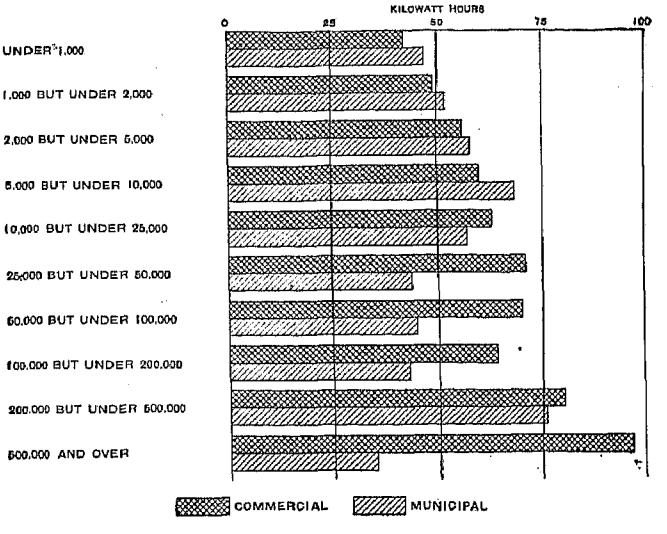
[1] Chapter II, p. 38.

plants. It is true that there are many plants in both groups which report the sale of no current for power. Were these eliminated there would remain in this tabulation 2,429 commercial plants which sell current for power and 1,213 of the corresponding municipal plants. Using these figures we should find the average power sales per plant to be 5,283,323 kilowatt hours for the former and 281,646 kilowatt hours for the latter. In the case of commercial plants having total power sales of 588,798,449, 10 were omitted from this tabulation. If these were included, the average power sales for this group would be appreciably higher than here indicated.

Per capita consumption of current for light and power: 1917.—From the special tabulation already made it is possible to arrive at the per capita consumption of electric current for light and power according to the various population groups. An explanation of the method whereby the basic data were secured has already been made.[1] It should be noted in this connection that while we might reasonably expect to find a gradual increase in the per capita consumption of current for lighting purposes as the population of the districts served increases, yet some qualification must be made because of the fact that in the case of commercial plants the larger population frequently represents merely an aggregate of relatively small municipalities. In the case of municipal plants, also, stations serving the larger population groups in many instances supply current only for lighting the streets and public buildings. Accordingly, the indicated per capita consumption for this group will naturally be low. The element of chance plays a far greater part in the matter of power sales per capita. Frequently an electric station serving a small territory may furnish great quantities of power to local industries either for manufacturing or for mining, in which case the density of service will appear abnormally high. Hence, except for the fact that the larger industrial establishments, which normally use a great deal of electric current, are not ordinarily to be found in the smaller population districts, the mere population of the territory served gives little clew to the population per capita consumption of current for power.

In examining Table 58 it is apparent that in the four lowest groups municipal plants led by a narrow margin in the amount of current supplied for light per inhabitant. In view of the fact that, as will be explained in the following chapter,[2] the average municipal plant is, relative to its size, far more liberally equipped with street lamps, it is reasonable to assume that in all probability those municipalities which own their lighting systems are more generous in all of their public lighting, whether of streets, parks, or buildings, than are the municipalities served by commercial stations. Local conditions might, of course, affect the situation in certain instances, though such differences are practically negligible when the average of large groups of plants is taken, as is here the case. Hence, no other explanation of the greater per capita consumption of current for light by the lower groups of municipal plants is apparent, since from analyses later to be made it will be found that the rates charged by municipal plants to private consumers in these groups do not tend to be much lower than the rates charged by corresponding commercial stations. In the population group between 10,000 and 25,000, municipal plants show a somewhat lower density of light service than do the corresponding commercial plants (57 as opposed to 63 kilowatt hours), but this difference is not greatly marked. In all remaining groups, however, commercial plants are very decidedly in the lead, except in the group between 200,000 and 500,000. The deficiency which the larger municipal plants show can no doubt be attributed mostly to the fact that many of them are furnishing current almost solely for public lighting purposes, while the commercial plants in the same territory do the general lighting business. However this may be, it is significant to find that the average number of kilowatt hours per capita supplied for light by all commercial plants is 79, while the average for all municipal plants is only 49. As the average for all plants in the United States is only 81 kilowatt hours, a little higher than the average for commercial plants, it appears that the actual duplication of territory served by municipal plants is relatively negligible.

DIAGRAM 13.—NUMBER OF KILOWATT HOURS SUPPLIED PER CAPITA FOR LIGHT BY COMMERCIAL AND MUNICIPAL PLANTS, ARRANGED ACCORDING TO POPULATION GROUPS: 1917.

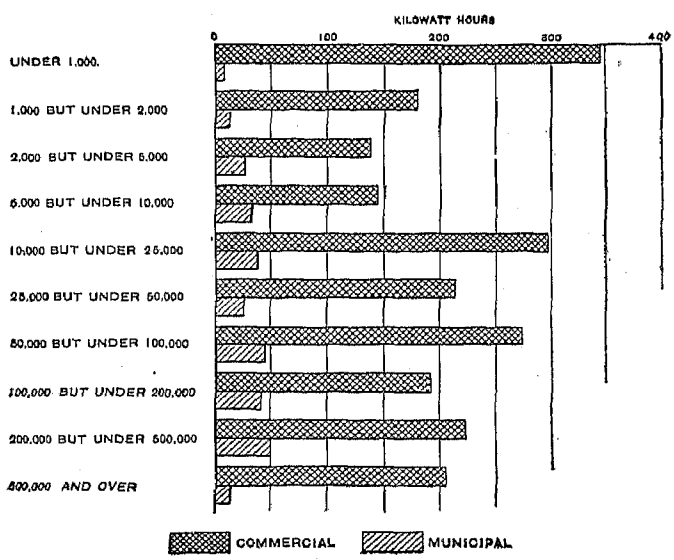


Certain striking contrasts are seen upon examination of the figures given in Table 58, showing the per capita consumption of power for commercial and

[1] Chapter II, p. 37. [2] Chapter VII, p. 93.

municipal plants in the various population groups. First of all, attention must be called to the condition which prevails among the municipal plants, since, on the average, they supply only 25 kilowatt hours per capita for power, whereas the average commercial plant supplies 217 kilowatt hours, an amount which would be increased to 227 if the 10 large plants omitted from the tabulation were included. Municipal plants show a fairly constant growth in the quantity of power furnished per capita as the population groups increase, until the highest group is reached. At every stage, however, the output for this purpose is so low, being in all cases far less than the output for light, that the figures are almost unbelievable when compared with the conditions found in the corresponding commercial stations. It must, of course, be remembered that 74 municipal plants, or about 3 per cent of the total number, supply current only for municipal uses, 67 of which furnish no power. This, however, is by no means sufficient to account for the obvious differences which in this respect exist between the two groups of stations, particularly when we recall that about an equal percentage of each supplies no current for power purposes. Hence, the condition evidently prevails in those districts served by municipal plants where either few industries capable of using electric power are present or those industries which are in the field apparently are forced to produce their own electric power, except in those comparatively few instances in which commercial plants are serving the same territory. This condition probably indicates a great lack of business initiative on the part of municipal plants.

DIAGRAM 14.—NUMBER OF KILOWATT HOURS SUPPLIED PER CAPITA FOR POWER BY COMMERCIAL AND MUNICIPAL PLANTS, ARRANGED ACCORDING TO POPULATION GROUPS: 1917.



It is surprising to find that while the highest per capita consumption of current for power in any one group is only 50 kilowatt hours for municipal plants and the lowest only 8, the corresponding extremes for commercial plants are 346 and 139 kilowatt hours. It is equally surprising to find that while, as would naturally be expected, the smallest per capita consumption (8) in municipal plants is met with in the lowest population group, the highest per capita consumption for power (346) is found in this same group of commercial plants. This condition in the latter is due to the fact that the states of Pennsylvania, West Virginia, Washington, and Arizona each reports a plant serving a very small population group, which supplies an unusually large quantity of current for power to manufacturing establishments or mines. But even if these abnormal cases were eliminated, the per capita amount of current supplied for power by commercial stations would still be about 50 kilowatt hours as opposed to only 8 for municipal plants supplying less than 1,000 population. Somewhat similar conditions, though far less marked, obtain among commercial plants in several of the other low population groups.

As a result of frequent inquiries which have been made during the past few years, it was deemed worth while to present figures showing as nearly as possible the per capita consumption of current for light and power, according to states and geographic divisions. It will, of course, be understood that the data can not always be considered absolutely accurate so far as different states are concerned, for reasons already pointed out in connection with the preceding study of per capita consumption. There may occasionally be some duplication of population which could not be discovered by the Census Bureau, and at this period it is not always possible to determine with accuracy the exact population of different municipalities. The material here presented, however, is nowhere else to be secured, and the percentage of error, particularly in the case of the different geographic divisions, will be very slight indeed.

In Table 59, therefore, is given not only the population of the various districts furnished with electric current but also the total population of all states according to the census estimate of January 1, 1918, which is the most nearly comparable date, since the schedules from central stations were to report conditions as of December 31, 1917. In some cases the estimated population may be considerably different from the true population, since the figures have generally been built up on the theory that the annual rate of increase in population in the different states since 1910 has been the same as the average rate of increase during the preceding decade. In 10 states, however, a population census was locally taken in 1915. These were New York, Rhode Island, New Jersey, Massachusetts, Iowa, Kansas, Florida, South Dakota, North Dakota, and Wyoming. Upon the whole, therefore, the ratio which appears to exist between the total estimated population of the different states and that portion of the population which is actually in a position to be supplied with electric current is a very close approximation. However, the

figures showing the per capita consumption of current for light and power, based on population actually served, will doubtless be even more accurate. From the nature of the service rendered by electric street railways, it was scarcely possible to include the power so used in the per capita consumption, nor would the figures have had any particular significance. Current sold to other central stations will, of course, ultimately appear in the returns as sold for light or power. Finally, it should be noted that the data assembled in Table 59, as in preceding tables on the same subject, are not wholly complete, due to the necessary omission of 11 plants which supply to an uncertain population 104,700 kilowatt hours for light and 588,798,449 kilowatt hours for power. No doubt this amount of current should be included in computing the per capita consumption, since the amount of population actually involved in connection with the supply of such large quantities of power is practically negligible.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—DENSITY OF ELECTRIC LIGHT AND POWER SERVICE IN THE UNITED STATES, BY GEOGRAPHIC DIVISIONS AND STATES: 1917.

Table 59

DIVISION AND STATE.	Number of stations.	POPULATION.			Number of kilowatt hours consumed for light.	Number of kilowatt hours consumed for power.	PER CAPITA CONSUMPTION (BASED ON POPULATION ACTUALLY SERVED).	
		Districts served with current.	Census estimate, Jan. 1, 1918.	Per cent of population served with electric current.			Light.	Power.
UNITED STATES	6,489	62,847,722	104,444,303	60.2	5,112,412,249	12,586,028,828	81	200
NEW ENGLAND	377	6,591,077	7,302,566	90.3	420,428,908	962,745,494	64	146
Maine	91	573,108	779,765	73.5	24,023,015	98,534,832	42	172
New Hampshire	58	382,267	445,390	85.8	19,008,406	29,191,528	50	76
Vermont	57	201,850	365,569	55.2	12,894,145	38,866,987	64	190
Massachusetts	120	3,769,586	3,804,381	99.1	246,026,275	498,349,082	65	132
Rhode Island	9	482,300	631,640	76.4	35,585,991	122,674,166	74	254
Connecticut	42	1,181,966	1,275,821	92.6	82,891,076	175,028,299	70	149
MIDDLE ATLANTIC	666	19,770,383	22,329,921	88.5	1,527,420,125	4,049,935,155	77	205
New York	326	10,165,376	10,553,585	96.3	958,781,017	2,214,436,204	94	218
New Jersey	62	2,694,555	3,047,282	88.4	137,658,117	289,340,369	51	107
Pennsylvania	278	6,910,452	8,729,054	79.2	430,980,991	1,546,158,582	62	224
EAST NORTH CENTRAL	1,373	13,335,408	20,018,689	66.6	1,319,668,089	2,182,324,930	99	164
Ohio	332	3,246,349	5,242,949	61.9	318,037,645	508,779,461	98	156
Indiana	236	1,646,064	2,844,829	57.9	111,516,382	220,786,350	68	134
Illinois	301	4,560,378	6,276,364	72.7	561,461,718	566,363,280	123	124
Michigan	238	2,424,100	3,113,972	77.8	223,592,830	642,603,477	92	205
Wisconsin	266	1,458,517	2,540,575	57.4	105,059,514	245,892,362	72	169
WEST NORTH CENTRAL	1,720	7,136,257	12,650,797	56.4	559,068,021	725,981,024	78	102
Minnesota	254	1,614,892	2,328,866	69.3	163,943,910	292,119,519	102	181
Iowa	322	1,093,950	[1] 2,224,771	49.2	77,062,091	55,800,569	70	51
Missouri	292	2,268,406	3,439,046	66.0	176,643,404	169,766,192	78	75
North Dakota	127	200,339	778,378	25.7	14,273,360	5,779,892	71	29
South Dakota	131	228,116	726,203	31.4	14,723,793	10,970,750	65	48
Nebraska	294	745,334	1,290,501	57.8	49,722,639	45,522,424	67	61
Kansas	300	985,220	1,863,032	52.8	62,698,824	146,021,678	64	148
SOUTH ATLANTIC	723	4,518,305	13,562,034	33.3	282,576,718	1,264,333,345	63	280
Delaware, District of Columbia, and Maryland	63	1,330,725	1,967,090	67.6	116,453,961	263,356,635	88	198
Virginia	94	615,487	2,223,527	27.7	22,860,468	73,045,745	37	119
West Virginia	72	363,804	1,425,883	25.5	46,162,481	113,244,904	127	311
North and South Carolina	238	1,156,833	4,102,272	28.2	48,215,369	687,341,251	42	594
Georgia	174	649,231	2,915,730	22.3	25,285,042	110,391,504	39	170
Florida	82	402,165	927,532	43.4	23,599,397	16,453,306	59	41
EAST SOUTH CENTRAL	410	2,422,376	9,082,884	26.7	134,979,387	287,617,110	56	119
Kentucky	125	887,909	2,401,320	37.0	53,703,123	45,000,910	60	51
Tennessee	106	639,157	2,312,941	27.6	41,263,713	70,649,999	65	111
Alabama	82	621,760	2,379,605	26.1	26,647,118	164,691,093	43	265
Mississippi	97	273,550	1,989,018	13.8	13,365,433	7,275,108	49	27
WEST SOUTH CENTRAL	636	3,526,324	10,542,614	33.4	203,973,735	213,709,122	58	61
Arkansas	96	398,218	1,779,655	22.4	18,973,852	9,690,497	48	24
Louisiana	85	660,522	1,870,366	35.3	50,124,948	26,033,482	76	39
Oklahoma	201	827,543	2,333,742	35.5	40,638,355	53,180,479	49	64
Texas	254	1,640,041	4,558,351	36.0	94,236,580	124,804,664	57	76
MOUNTAIN	334	1,671,383	3,381,994	49.4	182,350,621	1,468,604,860	109	873
Montana	60	224,810	479,655	46.9	32,761,568	791,750,693	146	3,522
Idaho	45	223,927	453,472	49.4	21,438,529	91,787,495	96	410
Wyoming	41	94,390	187,675	50.3	10,959,791	10,913,272	116	116
Colorado	69	467,759	1,001,451	46.7	55,946,573	148,089,878	120	317
New Mexico	29	94,798	430,332	22.0	5,756,408	6,991,626	61	74
Arizona	29	146,123	267,912	54.5	10,303,467	53,685,821	71	367
Utah	47	373,391	448,757	83.2	39,080,832	319,654,975	105	856
Nevada	14	46,185	112,740	41.0	6,103,453	35,731,100	132	774
PACIFIC	250	3,876,209	5,578,329	69.5	481,946,645	1,440,777,788	124	372
Washington	86	757,159	1,628,989	46.5	62,526,140	118,968,298	83	157
Oregon	67	527,472	875,117	60.3	26,011,223	55,573,337	49	105
California	97	2,591,578	3,074,223	84.3	393,409,282	1,266,236,153	152	489

[1] Population Apr. 15, 1910; decrease since 1900.

In many cases it is not easy to account for the wide differences in the per capita consumption of current for light in various geographic divisions and states. Sometimes, to be sure, current sold for power was included with that sold for light on the returns, but the cases in which large quantities were involved in this way were comparatively rare and would not be sufficient to account for the noticeable discrepancies, which must, accordingly, depend largely upon local conditions. So far as the different divisions are concerned,

the Pacific leads with 124 kilowatt hours, followed by the Mountain (109) and the East North Central (99). Those states reporting the highest per capita consumption of current for lighting purposes are California (152), Montana (146), Nevada (132), West Virginia (127), Illinois (123), Colorado (120), Wyoming (116), Utah (105), and Minnesota (102). In four of these states—California, Montana, Nevada, and Utah—the bulk of the electric current was generated by means of water power and supplied at very favorable rates to customers who, no doubt, were rather wasteful in its use. It is further true that, with one or two exceptions, a great deal of mining is done in these sections, and probably a large quantity of current is used for lighting many of the mines. The high per capita consumption for light in Illinois (123), which is practically the same as the per capita power consumption (124), is doubtless accounted for by the inclusion of an appreciable amount of current actually sold for power with that sold for light in the case of one of the largest companies. The lowest per capita consumption for light is found in the East South Central division (56), the West South Central (58), and the South Atlantic (63). Among the states the lowest consumption is reported by Virginia (37), Georgia (39), Maine (42), North and South Carolina (42), Alabama (43), Arkansas (48), Mississippi, Oklahoma, and Oregon (49). In practically all of these the rural population is large and municipalities are correspondingly small, and, with two exceptions, they are all Southern states in which the Negro population is very dense. In these poorer districts the candle and the kerosene lamp doubtless still hold sway. Ten states—Iowa, Missouri, North Dakota, South Dakota, Nebraska, Florida, Kentucky, Mississippi, Arkansas, and Louisiana, in the order named—report higher per capita consumption for light than for power.

The per capita consumption of power in all districts served in the United States is 200 kilowatt hours, or 210 if the 10 large plants omitted from the tabulation be included. This figure indicates a density of power service about two and one-half times as great as the density of lighting service. The highest per capita consumption of current for power is met with in the Mountain division, which reports 873 kilowatt hours—a figure which is much more than twice as high as that shown by the Pacific division (372), which is second in rank. The South Atlantic division follows with a per capita consumption of 280 kilowatt hours. Upon examining the various states which compose these divisions, it appears that these extremely high figures are usually accounted for by only one or two states. In the Mountain division, for example, Montana shows a per capita consumption of 3,522 kilowatt hours for power, which is between four and five times as high as that found in Utah (856) or Nevada (774), the two closest rivals. In the entire Mountain division, however, with two exceptions, Wyoming and New Mexico, the per capita consumption is higher than in most other states. This would seem to be accounted for by the enormous quantity of electric power used in mining operations in these sparsely populated states, particularly in Montana, Utah, and Nevada. In Idaho, also, a good deal of electricity generated by water power is used in the various farm operations as well as for heating purposes. California, in which are found the most extensive hydroelectric developments in any state in the Union, ranks among the highest in the per capita consumption of power (489 kilowatt hours), in addition to being first in use of current for lighting purposes. North and South Carolina, which have been combined in this tabulation owing to the difficulty in determining to which state belong portions of the population served, together show a per capita power consumption considerably higher than that found in California and rank fourth among all the states in this respect. Here, again, most current is generated by water power and is extensively used in textile and other mills. None of the so-called "industrial" states appear to have a per capita power consumption at all approaching the states already mentioned. This condition is in large measure accounted for by the fact that so much greater population is served in these more highly developed sections with light as well as with power. Accordingly, the population which must be used as our divisor is relatively far greater and the quotient is correspondingly less. Further, in these older states, many manufacturing establishments are using steam for motive power or are generating electricity in their own plants.

Subject to the qualifications and explanations which have earlier been made, perhaps attention should be directed briefly to the proportion of population which is reported as being served with electric current in the different sections of the country. Based on the census estimate for January 1, 1918, it appears that in the New England division 90.3 per cent of the total population was living in districts which presumably are in a position to be served with electric current. This division is closely followed by the Middle Atantic, with 88.5 per cent, while the Pacific division, reports 69.5 per cent of the total population, and the East North Central 66.6 per cent. The highest ranking states are Massachusetts, with the somewhat questionable figure of 99.1 per cent, New York (96.3 per cent), Connecticut (92.6 per cent), New Jersey (88.4 per cent), New Hampshire (85.8 per cent), California (84.3 per cent), and Utah (83.2 per cent). In most of these states the ratio of urban population to rural population is extremely high, but it should be remembered that by far the greater number, at least two-thirds, of central electric stations in the United States are serving a population which is so small, under 2,500, that it is classified by the Census Bureau as "rural." The low ranking divisions are all in the South, the East South Central (26.7 per cent), the South Atlantic (33.3 per cent), and the West South

Central (33.4 per cent). In the states comprising these divisions we find an overwhelming proportion of country dwellers, though not all of the states showing a very low proportion of population served by electric plants are to be found in these sections. The following states are among the most sparsely served in the order named, all of which report less than 30 per cent: Mississippi (13.8 per cent), New Mexico (22 per cent), Georgia (22.3 per cent), Arkansas (22.4 per cent), West Virginia (25.5 per cent), North Dakota (25.7 per cent), Alabama (26.1 per cent), Tennessee (27.6 per cent), Virginia (27.7 per cent), and North and South Carolina combined (28.2 per cent).

Combined data on the equipment and output of central electric stations and electric railways.—While, from time to time, attention has been called to the United States totals which include both street railways and central stations, it may be of some interest to the reader here to sum up in tabular form the combined figures for equipment and output for states and divisions as well as for the United States at the last three census periods.

After the detailed analyses which have already been made of the figures relating to the primary power equipment, together with the dynamos and output of central stations, it is probably unnecessary to make extended comment on Table 60, in which totals are assembled. Attention should, however, be called to the states and divisions which in 1917 stood highest in generating capacity and output when the street railway industry was added to the central station industry.

COMPARATIVE SUMMARY—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, DYNAMO CAPACITY, AND OUTPUT OF STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1917, 1912, AND 1907.

Table 60

DIVISION AND STATE.	Census year.	PRIMARY POWER.						KILOWATT CAPACITY OF DYNAMOS.			Total kilowatt hours generated.
		Total horsepower.	Steam engines and steam turbines.		Internal-combustion engines.		Water wheels.		Total.	Direct current.	Alternating current.	
			Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.				
UNITED STATES	1917	17,136,947	9,228	11,992,991	2,987	238,700	3,690	4,905,256	11,919,186	968,723	10,950,463	32,678,806,061
	1912	11,191,429	10,105	8,115,666	1,164	135,225	3,322	2,940,538	7,670,755	1,243,365	6,427,390	17,571,768,921
	1907	6,618,011	11,422	5,104,800	504	72,163	2,709	1,441,048	4,432,641	1,428,954	3,003,687	10,621,406,837
GEOGRAPHIC DIVISIONS:												
New England	1917	1,788,740	755	1,388,712	47	5,605	616	394,423	1,272,322	160,837	1,111,485	2,642,446,330
	1912	1,157,132	885	903,604	55	10,017	572	243,511	820,628	210,017	610,611	1,541,921,385
	1907	718,499	1,126	566,829	39	6,823	520	144,847	501,427	240,673	260,754	1,015,385,019
Middle Atlantic	1917	4,430,374	1,580	3,508,290	190	31,819	602	890,265	3,069,676	258,521	2,811,155	9,331,673,441
	1912	2,991,020	1,961	2,291,573	192	33,939	595	665,508	2,047,134	340,876	1,706,258	5,371,253,169
	1907	1,927,114	2,478	1,561,260	118	17,137	532	348,717	1,338,048	449,593	888,455	3,679,460,449
East North Central	1917	3,866,479	2,280	3,363,517	457	31,883	799	471,079	2,743,769	247,916	2,495,853	7,532,355,405
	1912	2,515,706	2,627	2,183,091	224	26,710	703	305,905	1,784,368	342,488	1,441,880	3,995,158,144
	1907	1,473,949	3,137	1,318,501	123	12,725	610	142,723	976,419	371,929	604,490	2,343,163,832
West North Central	1917	1,503,933	1,548	1,080,850	1,383	77,414	317	345,669	1,077,751	97,767	979,984	2,454,144,137
	1912	929,220	1,513	706,922	424	29,578	272	132,720	641,343	113,222	528,121	1,209,359,546
	1907	577,054	1,538	468,027	97	7,336	200	101,691	379,206	113,895	265,311	786,641,429
South Atlantic	1917	1,675,063	960	921,496	152	23,212	417	730,355	1,119,602	64,170	1,055,432	2,587,663,188
	1912	1,004,038	945	587,888	60	11,373	385	404,777	682,325	79,616	602,709	1,074,027,912
	1907	552,496	950	374,427	31	6,520	266	171,549	367,195	89,764	277,431	643,771,881
East South Central	1917	666,725	634	427,152	119	4,680	81	234,893	476,037	47,924	428,113	1,252,280,629
	1912	354,338	616	315,628	13	1,080	47	37,630	241,347	48,286	193,061	476,150,487
	1907	218,799	603	210,492	3	60	29	8,247	147,736	43,924	103,812	298,426,946
West South Central	1917	494,454	851	438,461	474	48,732	41	7,261	352,371	46,502	305,869	788,185,132
	1912	344,799	890	318,767	153	17,354	35	8,678	242,617	48,608	194,009	425,302,675
	1907	206,039	813	199,287	59	3,690	24	3,062	136,856	51,604	85,252	258,425,302
Mountain	1917	861,222	324	228,287	123	11,940	371	620,995	574,432	13,909	560,523	2,135,949,169
	1912	516,451	303	179,217	20	2,695	310	334,539	317,176	17,089	300,087	980,641,612
	1907	261,597	337	112,244	13	855	231	148,498	175,220	22,677	152,543	446,471,639
Pacific	1917	1,849,957	296	636,226	42	3,415	446	1,210,316	1,233,226	31,177	1,202,049	3,954,108,630
	1912	1,378,725	365	568,976	23	2,479	403	807,270	893,817	43,163	850,654	2,497,953,991
	1907	682,464	440	203,733	21	17,017	297	371,714	410,534	44,895	365,639	1,149,660,340
NEW ENGLAND:												
Maine	1917	143,796	80	36,846	7	180	219	106,770	86,056	7,080	78,976	227,101,085
	1912	129,773	89	34,136	3	135	199	95,502	89,991	17,387	72,604	171,241,221
	1907	78,225	115	31,459	.....	.....	164	46,766	52,947	14,755	38,192	95,270,975
New Hampshire	1917	97,313	51	36,104	11	1,228	108	59,891	68,235	3,961	64,274	165,947,288
	1912	88,330	64	27,306	11	1,905	117	59,119	60,503	4,796	55,707	131,950,020
	1907	50,414	70	23,095	8	1,115	103	26,204	34,637	6,112	28,525	58,209,739
Vermont	1917	82,154	33	17,485	1	50	123	64,619	59,478	1,917	57,561	76,681,434
	1912	58,018	54	17,996	2	95	120	39,927	36,212	3,372	32,840	49,527,559
	1907	44,016	50	12,589	4	205	107	31,222	26,729	4,776	21,953	34,056,513
Massachusetts	1917	1,015,075	399	886,792	18	2,187	102	126,096	712,552	112,694	599,858	1,474,165,620
	1912	623,576	467	591,515	27	5,872	70	26,189	450,236	136,786	313,450	838,789,192
	1907	387,422	620	365,216	17	3,797	73	18,409	275,116	154,537	120,579	589,133,532
Rhode Island	1917	191,171	33	186,308	5	1,125	17	3,738	147,117	7,100	140,017	236,771,687
	1912	95,349	37	91,784	5	1,125	13	2,440	70,109	13,959	56,150	124,222,051
	1907	57,071	70	53,808	4	1,000	16	2,263	41,840	23,681	18,159	93,410,987
Connecticut	1917	259,231	159	225,087	5	835	47	33,309	198,884	28,085	170,799	461,779,216
	1912	162,086	174	140,867	7	885	53	20,334	113,577	33,717	79,860	226,191,342
	1907	101,351	201	80,662	6	706	57	19,983	70,158	36,812	33,346	145,303,273

COMPARATIVE SUMMARY—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, DYNAMO CAPACITY, AND OUTPUT OF STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1917, 1912, AND 1907—Contd.

Table 60—Continued.

DIVISION AND STATE.	Census year.	PRIMARY POWER.							KILOWATT CAPACITY OF DYNAMOS.			Total kilowatt hours generated.
		Total horsepower.	Steam engines and steam turbines.		Internal-combustion engines.		Water wheels.		Total.	Direct current.	Alternating current.	
			Number.	Horsepower.	Number.	Horsepower.	Number.	Horsepower.				
MIDDLE ATLANTIC:												
New York	1917	2,502,992	677	1,772,619	78	8,543	455	721,830	1,730,093	112,729	1,617,364	5,082,659,030
	1912	1,813,529	781	1,273,422	76	9,186	436	530,921	1,216,336	140,143	1,076,193	3,374,059,343
	1907	1,139,804	912	819,079	32	5,290	386	315,435	793,446	226,994	566,452	2,420,974,919
New Jersey	1917	380,709	207	381,837	26	3,545	12	1,327	264,071	42,269	221,802	804,126,066
	1912	268,612	296	264,683	21	2,360	18	1,569	203,209	49,560	153,649	417,089,681
	1907	185,537	335	182,415	11	1,328	22	1,794	137,298	48,866	88,432	318,320,064
Pennsylvania	1917	1,540,673	696	1,353,834	86	19,731	135	167,108	1,075,512	103,523	971,989	3,444,888,345
	1912	908,879	884	753,468	95	22,393	141	133,018	627,589	151,173	476,416	1,580,104,145
	1907	601,773	1,231	559,766	75	10,519	124	31,488	407,304	173,733	233,571	940,165,466
EAST NORTH CENTRAL:												
Ohio	1917	1,101,823	648	1,068,830	121	12,258	47	20,726	758,522	107,648	650,874	2,088,623,094
	1912	670,347	787	648,155	95	11,502	38	10,690	477,903	136,640	341,263	1,011,186,644
	1907	415,256	899	406,091	55	5,878	26	3,287	282,182	126,946	155,236	667,104,385
Indiana	1917	470,033	446	439,102	46	3,268	90	27,663	353,087	22,424	330,663	729,628,669
	1912	307,423	446	281,468	19	2,040	90	23,915	228,748	26,610	202,138	454,911,393
	1907	196,967	507	176,066	15	1,295	83	19,606	136,666	35,890	100,776	274,795,437
Illinois	1917	1,194,108	587	1,125,337	119	4,661	105	64,110	841,096	60,872	780,224	2,467,354,650
	1912	820,411	691	774,807	35	3,042	105	42,562	604,288	112,163	492,125	1,549,487,964
	1907	497,492	674	484,991	19	870	86	11,631	334,045	138,379	195,666	943,681,414
Michigan	1917	679,047	309	472,458	77	3,074	318	203,515	500,853	25,525	475,328	1,619,093,810
	1912	445,462	389	309,382	27	1,626	262	134,454	291,535	31,811	259,724	649,339,814
	1907	241,052	440	154,711	11	603	249	85,738	139,638	37,428	102,210	318,743,484
Wisconsin	1917	421,468	290	257,781	94	8,622	239	155,065	290,211	31,447	258,764	627,655,182
	1912	272,063	314	169,279	43	8,500	208	94,284	181,894	35,264	146,630	330,232,329
	1907	123,182	317	96,642	23	4,079	166	22,461	83,888	33,286	50,602	138,939,112
WEST NORTH CENTRAL:												
Minnesota	1917	350,741	256	219,001	148	8,092	108	123,648	254,254	10,999	243,255	593,401,856
	1912	261,994	262	154,767	54	4,755	124	102,172	173,070	17,922	155,148	275,281,155
	1907	173,055	267	89,691	22	1,428	83	81,936	113,434	18,672	94,762	189,029,616
Iowa	1917	364,379	338	189,250	158	7,251	95	167,878	258,697	20,110	238,587	768,101,027
	1912	133,593	374	123,906	52	2,658	58	7,029	96,210	28,172	68,038	150,640,398
	1907	79,089	369	74,692	11	564	44	3,833	56,078	27,379	28,699	79,979,727
Missouri	1917	362,258	348	336,298	174	7,205	12	18,665	267,368	34,793	232,575	567,419,311
	1912	308,035	371	303,661	22	2,472	5	1,902	214,931	42,199	172,732	500,619,707
	1907	202,938	452	199,973	13	963	5	2,002	129,572	41,713	87,859	375,903,548
North Dakota	1917	29,079	117	24,679	157	4,400	.....	.....	20,041	7,249	12,792	22,978,006
	1912	16,249	75	15,931	8	318	.....	.....	11,024	4,807	6,217	12,334,553
	1907	10,527	61	10,222	2	205	1	100	6,003	4,063	2,030	8,261,885
South Dakota	1917	33,126	57	16,150	178	10,006	11	6,970	24,323	2,913	21,410	31,810,487
	1912	27,748	50	16,003	86	4,832	15	6,913	20,032	2,492	17,540	24,703,754
	1907	12,984	52	10,251	10	528	12	2,205	10,046	1,488	8,558	13,615,015
Nebraska	1917	139,706	199	115,282	284	13,980	57	10,504	98,702	11,243	87,459	178,772,645
	1912	71,293	168	61,577	91	3,832	44	5,884	48,011	8,985	39,026	95,169,030
	1907	42,102	154	38,303	17	845	19	2,954	28,041	9,655	18,386	52,026,421
Kansas	1917	224,584	233	180,190	284	26,390	34	18,004	154,366	10,460	143,906	291,660,805
	1912	110,608	213	91,077	111	10,711	26	8,820	78,065	8,645	69,420	150,610,949
	1907	56,359	183	44,895	22	2,803	36	8,661	35,942	10,925	25,017	67,825,217
SOUTH ATLANTIC:												
Delaware	1917	34,707	28	34,060	1	22	5	625	20,997	2,798	18,199	52,400,045
	1912	24,901	42	23,825	3	250	8	826	16,095	4,975	11,120	25,840,778
	1907	14,800	47	14,515	.....	.....	5	285	12,408	7,767	4,641	12,238,788
Maryland	1917	167,087	78	163,467	17	1,215	19	2,405	119,533	11,552	107,981	229,165,814
	1912	125,638	112	121,592	8	823	25	3,223	91,364	16,077	75,287	36,758,346
	1907	118,531	150	117,054	5	130	13	1,347	74,708	17,963	56,745	153,451,176
District of Columbia	1917	120,690	22	120,690	.....	.....	.....	.....	68,350	5,350	63,000	170,286,766
	1912	77,230	24	77,230	.....	.....	.....	.....	57,058	8,458	48,600	116,923,803
	1907	38,290	42	38,290	.....	.....	.....	.....	27,727	8,627	19,100	66,006,336
Virginia	1917	212,566	125	136,871	22	821	91	74,874	151,202	14,518	136,684	318,007,783
	1912	160,489	125	93,905	3	185	92	66,399	116,496	12,040	104,456	145,024,055
	1907	82,482	138	55,046	5	960	69	26,476	55,951	21,112	34,839	94,939,273
West Virginia	1917	165,735	116	140,036	33	12,300	15	6,499	127,246	12,155	115,091	290,968,487
	1912	68,925	132	59,804	24	3,085	14	6,036	49,767	11,980	37,787	102,198,976
	1907	42,891	118	37,989	12	1,275	11	3,627	31,294	9,869	21,425	64,729,936
North Carolina	1917	254,671	132	80,303	19	2,111	89	172,257	171,545	2,351	169,194	400,214,560
	1912	93,713	118	31,882	5	1,680	76	60,151	61,389	4,059	57,330	88,701,305
	1907	33,108	116	20,296	.....	.....	52	12,812	23,746	4,317	19,429	33,969,179
South Carolina	1917	300,590	93	49,099	13	482	90	251,099	185,005	2,292	182,713	541,309,833
	1912	230,606	84	51,696	3	455	88	178,555	140,986	4,878	136,108	365,575,958
	1907	103,731	86	20,111	1	150	58	83,470	64,663	3,373	61,290	96,312,449
Georgia	1917	326,917	202	107,913	18	3,518	95	215,486	213,612	7,316	206,296	503,320,362
	1912	170,832	195	84,625	5	3,720	71	82,487	112,841	9,976	102,865	142,082,277
	1907	93,380	155	48,108	2	3,140	50	42,132	60,438	11,494	48,944	94,637,017
Florida	1917	92,100	164	82,247	29	2,743	13	7,110	62,112	5,838	56,274	81,989,538
	1912	51,704	113	43,429	9	1,175	11	7,100	36,329	7,173	29,156	50,922,414
	1907	25,283	98	23,018	6	865	8	1,400	16,260	5,242	11,018	27,487,727

COMPARATIVE SUMMARY—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, DYNAMO CAPACITY, AND OUTPUT OF STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES: 1917, 1912, AND 1907—Contd.

Table 60—Continued.

DIVISION AND STATE.	Census year.	PRIMARY POWER. Total horsepower.	Steam engines and steam turbines. Number.	Steam engines and steam turbines. Horsepower.	Internal-combustion engines. Number.	Internal-combustion engines. Horsepower.	Water wheels. Number.	Water wheels. Horsepower.	KILOWATT CAPACITY OF DYNAMOS. Total.	Direct current.	Alternating current.	Total kilowatt hours generated.
EAST SOUTH CENTRAL:												
Kentucky	1917	140,462	184	137,776	63	2,301	7	385	100,067	15,471	84,596	193,887,625
	1912	108,227	188	107,651	6	576	.....	.....	69,867	16,149	53,718	149,408,553
	1907	71,409	192	71,394	1	15	.....	.....	48,210	17,429	30,781	90,658,286
Tennessee	1917	255,445	156	123,162	19	631	56	131,652	188,540	13,646	169,894	655,596,031
	1912	122,361	164	94,166	4	445	32	27,750	85,690	15,213	70,477	157,305,115
	1907	68,385	165	67,145	.....	.....	14	1,240	46,718	11,922	34,796	98,498,291
Alabama	1917	221,495	144	117,934	8	705	18	102,856	156,609	14,981	141,628	352,275,905
	1912	83,403	122	73,504	2	19	15	9,880	57,277	13,967	43,310	131,557,661
	1907	52,619	114	45,592	1	20	15	7,007	36,024	11,542	24,482	78,954,853
Mississippi	1917	49,323	150	48,280	29	1,043	.....	.....	35,821	3,826	31,995	50,520,468
	1912	40,347	142	40,307	1	40	.....	.....	28,513	2,957	25,556	37,879,158
	1907	26,386	132	26,361	1	25	.....	.....	16,784	3,031	13,753	30,315,516
WEST SOUTH CENTRAL:												
Arkansas	1917	53,249	144	48,148	44	2,561	10	2,540	37,370	11,854	25,516	71,725,478
	1912	42,604	134	39,343	5	221	10	3,040	30,442	6,610	23,832	42,025,641
	1907	24,494	125	24,182	1	12	1	300	17,012	5,714	11,298	27,867,049
Louisiana	1917	95,864	103	88,867	74	6,997	.....	.....	66,890	15,583	51,307	158,471,436
	1912	70,910	118	69,920	9	990	.....	.....	52,059	21,372	30,687	104,591,816
	1907	66,723	171	66,303	3	420	.....	.....	41,678	23,865	17,813	93,441,254
Oklahoma	1917	97,312	231	82,684	137	13,260	5	1,368	67,323	4,265	63,058	121,222,945
	1912	63,597	204	55,196	39	6,266	7	2,135	45,931	4,895	41,036	65,217,869
	1907	24,423	117	24,223	2	200	.....	.....	16,999	3,420	13,579	26,993,403
Texas	1917	248,029	373	218,762	219	25,914	26	3,353	180,788	14,800	165,988	436,765,273
	1912	167,688	434	154,308	100	9,877	18	3,503	114,185	15,731	98,454	212,867,349
	1907	90,399	400	84,579	53	3,058	23	2,762	61,167	18,605	42,562	110,123,596
MOUNTAIN:												
Montana	1917	279,004	39	8,084	39	1,403	78	268,917	182,079	1,852	180,227	905,453,777
	1912	117,230	39	13,500	1	75	67	103,655	75,468	2,705	72,763	381,012,617
	1907	69,967	33	12,980	.....	.....	62	56,987	40,402	3,210	37,192	137,379,261
Idaho	1917	56,422	10	2,650	4	148	71	53,624	37,103	99	37,004	145,307,596
	1912	56,375	14	4,525	.....	.....	63	51,850	35,659	129	35,530	115,812,292
	1907	13,694	19	2,202	.....	.....	37	11,492	7,082	147	6,935	9,577,588
Wyoming	1917	27,462	58	22,837	23	1,937	12	2,688	20,627	662	19,965	27,391,551
	1912	11,596	45	10,162	1	100	11	1,334	8,212	1,077	7,135	11,580,507
	1907	5,125	34	4,360	.....	.....	6	765	3,208	1,003	2,205	5,499,084
Colorado	1917	198,148	131	121,206	11	527	66	76,415	134,561	9,996	124,565	372,451,450
	1912	180,266	119	99,831	1	80	69	80,355	101,360	10,241	91,119	263,111,504
	1907	104,217	164	76,457	4	300	52	27,460	66,764	14,104	52,660	165,385,828
New Mexico	1917	17,108	37	13,226	22	3,252	7	630	12,713	936	11,777	17,244,768
	1912	11,015	32	8,428	9	1,770	9	817	7,981	876	7,105	9,027,824
	1907	5,728	30	5,215	.....	.....	6	513	4,894	1,655	3,239	5,519,014
Arizona	1917	39,651	29	24,395	16	4,056	4	11,200	27,637	300	27,337	67,258,713
	1912	22,675	35	13,375	.....	.....	4	9,300	15,151	991	14,160	33,645,484
	1907	7,746	32	6,926	3	70	4	750	5,063	901	4,162	9,611,342
Utah	1917	226,595	15	34,189	.....	.....	112	192,406	147,359	64	147,295	486,995,136
	1912	101,874	13	27,186	.....	.....	74	74,688	62,835	735	62,100	121,481,552
	1907	48,140	21	3,869	.....	.....	55	44,271	42,117	1,597	40,520	83,876,892
Nevada	1917	16,832	5	1,100	8	617	21	15,115	12,353	.....	12,353	53,846,178
	1912	15,420	6	2,210	8	670	13	12,540	10,513	338	10,175	44,960,772
	1907	6,980	4	235	6	485	9	6,260	5,690	60	5,630	29,621,730
PACIFIC:												
Washington	1917	425,262	79	74,389	16	600	120	350,273	273,035	10,755	262,280	869,319,676
	1912	341,701	83	71,895	3	165	107	269,641	209,913	10,808	199,105	510,822,535
	1907	109,661	114	48,553	2	90	51	61,018	94,987	12,869	82,118	283,302,100
Oregon	1917	182,656	58	61,012	15	578	104	121,066	112,797	4,420	108,377	325,973,288
	1912	155,465	72	49,829	9	334	88	105,302	71,156	5,249	65,907	228,398,346
	1907	126,815	66	24,581	6	182	72	102,052	32,667	3,957	28,710	92,880,992
California	1917	1,142,039	159	500,825	11	2,237	222	738,977	847,394	16,002	831,392	2,758,815,666
	1912	881,559	210	447,252	11	1,980	208	432,327	612,748	27,106	585,642	1,758,733,110
	1907	445,988	260	220,599	13	16,745	174	208,644	282,880	28,069	254,811	773,477,158

Six divisions reported a total of more than 1,000,000 horsepower in 1917—the Middle Atlantic (4,430,374), East North Central (3,866,479), Pacific (1,849,957), New England (1,788,740), South Atlantic (1,675,063), and West North Central (1,503,933). The leading states in 1917, so far as primary power is concerned, were New York (2,502,992 horsepower), Pennsylvania (1,540,673), California (1,242,039), Illinois (1,194,108), Ohio (1,101,823), and Massachusetts (1,015,075). Those divisions which led in total primary power reported were also first in the matter of generating equipment, though not always in the same order—Middle Atlantic (3,069,676 kilowatts), East North Central (2,743,769), New England (1,272,322), Pacific (1,233,226), South Atlantic (1,119,602), and West North Central (1,077,751). The fact that the Pacific and the New England divisions have their positions reversed from that which

they held in primary horsepower probably indicates that in these Western states, particularly in California, there is a good deal of water horsepower in process of development. Those states which led in dynamo capacity are New York (1,730,093 kilowatts), Pennsylvania (1,075,512), California (847,394), Illinois (841,096), Ohio (758,522), Massachusetts (712,552), and Michigan (500,853). No other states approach near these in kilowatt capacity reported.

Finally, attention should be called to the total number of kilowatt hours generated. In this respect the various divisions group themselves pretty much in the same order as for generating equipment, the Middle Atlantic leading, with 9,331,673,441 kilowatt hours, followed by the East North Central (7,532,355,405 kilowatt hours), the Pacific (3,954,108,630), New England (2,642,446,330), South Atlantic (2,587,663,188), West North Central (2,454,144,137), and Mountain (2,135,949,169). The other divisions reported much smaller amounts. Evidently the central stations in the Pacific division, which, while reporting slightly less generating capacity than the New England division, have produced almost 50 per cent more current, are operating under much more satisfactory conditions. It is not always possible to determine from the generating capacity reported what amount of current will be produced in the different states. New York, however, naturally stands first, with 5,082,659,030 kilowatt hours, followed by Pennsylvania, with 3,444,888,345 kilowatt hours. Next come California (2,758,815,666 kilowatt hours), Illinois (2,467,354,650), Ohio (2,088,623,094), Michigan (1,619,093,810), Massachusetts (1,474,165,620), Montana (965,453,777), Washington (869,319,676), New Jersey (804,126,066), Iowa (768,101,027), Indiana (729,628,669), Tennessee (655,596,631), Wisconsin (627,655,182), Minnesota (593,401,856), Missouri (567,419,311), South Carolina (541,309,833), and Georgia (503,320,362).

CHAPTER VII.—LINE EQUIPMENT, SUBSTATION EQUIPMENT, AND CUSTOMERS.

Nature of the statistics.—In this census statistics were secured regarding the substation and subsidiary equipment, such as rotary converters and motor generator sets, boosters, transformers, and storage batteries. But more attention has been given to the number of street lamps of all kinds, stationary motors served, and number of meters and customers. Special effort has already been made to work out certain significant relations between the population of the districts served by commercial and municipal plants, and the number of customers, amount of service per customer, etc.

In previous years an attempt was made to secure the estimated number of customers' lamps wired for service, but, in view of the fact that the data collected, while having a certain general interest, were open to serious question, being, in the main, rather rough estimates, it was thought best not to collect these statistics in 1917. There are also many other features of line equipment regarding which it would be interesting, for certain purposes, to have conclusive data, as, for example, the number of miles of wire, length of conduits and cables therein, and the number of poles and line transformers. In 1902 and 1907 some very unsatisfactory attempts were made to secure such data, and in 1912 the effort was discontinued.

Street lamps.—For the purposes of this census, in accordance with the practice of 1912, street lamps have been classified merely as "arc," "incandescent," and "other varieties." A few words of explanation, however, may be in order. Arc lamps are of several kinds: First, the old carbon arc, now practically out of use, which may be of the open or inclosed type, and which has a very low degree of efficiency, that is, it consumes a high amount of electric current in proportion to the candlepower of light produced; secondly, there is the so-called flaming arc, which may also be "open" or "inclosed," the light production of which depends upon the luminescence of carbon, impregnated with certain mineral salts; and finally, there is the so-called magnetite arc, a lamp of the highest efficiency, the electrodes of which consist of copper and a tube packed with magnetite and other minerals. No figures were secured showing the relative use of these different kinds of arcs.

Under "Incandescent lamps" are really included only the commoner kinds of incandescents—the "vacuum" type—namely, the carbon, gem or metallized carbon, tantalum, and tungsten, or mazda, as it is sometimes commercially called. Of these types the "carbon filament," which was the earlier invention, has been used in rapidly decreasing proportions for the last 10 or 12 years, because of its relatively low efficiency, until at the present time it is practically supplanted by the tungsten or occasionally by the gem. The tantalum lamp has never been of much commercial importance.

Under "Other varieties" are included those types of incandescents which are sometimes referred to as "gas filled," as contrasted with the "vacuum" lamps, above referred to, and Nernst lamps. Under this head the nitrogen-filled tungsten lamp of unusually high efficiency is most common, while the Nernst, the luminous element of which consists of a glower of refractory earth oxide operating in the atmosphere, has practically passed out of use, as its efficiency is much inferior to that of the metal filament lamps; and finally, this class also includes the different varieties of mercury-vapor arc lamps, in which the light is emitted entirely from luminous conducting vapors arising from the action of electric current on mercury electrodes. However, so far as street lamps are concerned, it is probable that practically all, if not all, the data returned under this head are for nitrogen-filled lamps.

Table 61 (p. 94) shows the relative growth for the entire central electric station industry in the United States in certain items of the line equipment since 1907. For the sake of completeness some data covering the electric station operations of those street railways which could not furnish complete separate reports have been included.

The number of street lamps was not reported either by the central electric stations or the electric railways in 1907, and in 1912 and 1917 the electric railways did not report the number and horsepower of stationary motors served or the number of customers' meters. Hence this table is significant merely to the extent that it shows the *actual* number of street lamps in use during 1912 and 1917. In passing, however, it is interesting to note that there has been an increase in the importance of the street lighting business done by the central station departments of electric railways. In 1917 this group of street railways reported over 11 per cent of the total number of street arcs, more than 12 per cent of incandescent lamps, and nearly 22 per cent of "other varieties," whereas in 1912 the proportions were over 9 per cent for arcs, a little more than 5 per cent for incandescents, and for "other varieties" 59 per cent. The total number of lamps of other varieties reported in 1912, 1,409, was, to be sure, almost negligible, and such lamps are at the present time of relatively small importance, since they comprise only three-fifths of 1 per cent of the total number of street lamps.

Table 61

CENTRAL ELECTRIC STATIONS AND STATIONS OPERATED IN CONNECTION WITH ELECTRIC RAILWAYS—LINE EQUIPMENT: 1917, 1912, AND 1907.

	Number of street lamps.			Stationary motors served.		Number of meters on consumption circuits
	Arc.	Incandescent.	Other varieties—Nernst, vapor, etc.	Number.	Horsepower.	
Total:						
1917	289,439	1,577,589	11,573	555,924	9,216,330	7,102,569
1912	385,057	719,631	1,409	435,473	4,130,619	3,617,189
1907	(1)	(1)	(1)	187,652	1,807,949	1,897,803
Central stations:						
1917	256,950	1,383,219	9,065	555,924	9,216,330	7,102,569
1912	348,643	681,379	578	435,473	4,130,619	3,617,189
1907	(1)	(1)	(1)	167,184	1,649,026	1,683,917
Electric railways:						
1917	32,489	194,361	2,508	(2)	(2)	(2)
1912	36,414	38,252	831	(2)	(2)	(2)
1907	(1)	(1)	(1)	20,468	158,923	213,886
	PER CENT OF INCREASE.[3]					
Total:						
1907–1917				196.2	409.8	274.2
1912–1917	−24.8	119.2	721.4	27.6	123.1	96.4
1907–1912				132.1	128.5	90.6
Central stations:						
1907–1917				232.5	458.9	321.8
1912–1917	−26.3	103.0	1,468.3	27.6	123.1	96.4
1907–1912				160.5	150.5	114.8
Electric railways:						
1907–1917						
1912–1917	−10.8	408.1	201.8			
1907–1912						

[1] Figures not available. [2] Not reported. [3] A minus sign (−) denotes decrease.

In Table 62 are given comparative statistics of line equipment for commercial and municipal stations for 1917, 1912, and 1907. From these data it can be seen that the total number of arc lamps has decreased 26.3 per cent since 1912. The rate of decrease, however, has been almost twice as rapid for the municipal as for the commercial stations. The number of incandescent lamps has a little more than doubled during the five-year period for both groups of stations, and, while there has been a very rapid rate of increase in "other varieties" of lamps, their relative importance, as above indicated, is negligible. Comparatively, however, it is highly significant that, while the arc lamps formed 33.8 per cent of all street lamps in 1912, in 1917 the proportion had dropped to 15.6 per cent. Mention should also be made of the fact that, while in 1917 municipal plants reported 28.7 per cent of all street lamps in that year, they served only 13.6 per cent of the total number of customers. The proportions were little different for 1912. Hence it would appear, from these figures alone, that the municipal plants are still stressing their street lighting business very heavily and that municipalities in general are probably more liberal in supplying themselves with street light by means of plants owned by themselves than when it is necessary to purchase current from other companies.

General comparisons.—A considerable amount of difficulty was experienced in collecting the statistics covering the number and horsepower of stationary motors which are expected to include all motors connected with the power circuits of central electric stations. Small fan motors and those of street railways were, of course, not included. Many large plants, however, because of the extent and nature of business in their districts, found it practically impossible to return, with any degree of accuracy, the number of stationary motors served, even though they were able to give a fair estimate of their total connected horsepower. Hence the statistics for 1917, as well as for earlier years, are not wholly complete, though they do indicate with a reasonable degree of accuracy the development of this phase of the industry. The details of this matter are discussed in connection with Tables 64 and 65.

At any rate, the increase both in number and horsepower of motors has been, during the last decade and during the five-year period 1912–1917, much more rapid for the municipal than for the commercial plants. This greater increase, however, has been due largely to the fact that in 1907 the municipal stations did practically no power business, and even in 1917 they returned a relatively small proportion of the total horsepower for all central electric stations, 4.6 per cent. On the other hand, municipal plants report 9.2 per cent of the total number of motors. These figures indicate in a rough sort of way that the average horsepower of motors for the municipal plants is much smaller than that for the commercial plants. It is highly significant that, while the number of motors *reported* for commercial plants increased only 22.1 per cent between 1912 and 1917, their total horsepower increased 121.6 per cent, while for municipal stations the increase in number was at the rate of 133.2 per cent, with an increase in horsepower of 159.1 per cent.

Table 62

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—LINE EQUIPMENT: 1917, 1912, AND 1907.

CLASS OF STATIONS.	Number of street lamps.			Stationary motors served.		Number of meters on consumption circuits.	Number of customers.
	Arc.	Incandescent.	Other varieties—Nernst, vapor, etc.	Number.	Horsepower.		
Total:							
1917	256,950	1,383,219	9,065	555,924	9,216,330	7,102,569	7,178,703
1912	348,643	681,379	578	435,473	4,130,619	3,617,189	3,837,518
1907	(1)	(1)	(1)	167,184	1,649,026	1,683,917	1,946,979
Commercial:							
1917	206,957	962,908	6,801	504,864	8,790,707	6,172,436	6,202,189
1912	264,152	474,048	440	413,578	3,966,328	3,146,998	3,311,870
1907	(1)	(1)	(1)	162,677	1,617,337	1,468,703	1,663,354
Municipal:							
1917	49,993	420,311	2,264	51,060	425,623	930,133	976,514
1912	84,491	207,331	138	21,895	164,291	470,191	525,648
1907	(1)	(1)	(1)	4,507	31,689	215,154	283,625
	PER CENT OF INCREASE.[2]						
Total:							
1907–1917				232.5	458.9	321.8	268.7
1912–1917	−26.3	103.0	1,468.3	27.6	123.1	96.4	87.1
1907–1912				160.5	150.5	114.8	97.1
Commercial:							
1907–1917				210.3	443.5	320.2	272.9
1912–1917	−21.7	103.1	1,445.7	22.1	121.6	96.1	87.3
1907–1912				154.2	145.2	114.3	99.1
Municipal:							
1907–1917				1,032.9	1,243.1	332.3	244.3
1912–1917	−40.8	102.7	1,540.6	133.2	159.1	97.8	85.8
1907–1912				385.8	418.4	118.5	85.3

[1] Figures not available.

[2] A minus sign (−) denotes decrease.

The number of customers' meters reported did not at earlier periods necessarily bear any close relation to the number of customers. Many small stations, even at the present time, sell their current on a "flat rate," not deeming it worth their while to go to the expense of providing meters. This is particularly true in the case of municipal plants. Further, in some cases a customer will have more than one meter, though, as is to be expected, at all periods the total number of customers was considerably in excess of the number of meters. The slightly more rapid rate of increase in the meters of municipal plants (332.3 per cent) than the rate of increase in commercial plants (320.2 per cent) is accounted for by the fact that since 1907 the municipal plants, relative to the number of customers served, were much less adequately supplied with meters. During the decade the increase in the number of customers has been somewhat more rapid at all periods for the commercial plants, though, as has been pointed out in a previous chapter, the number of such plants increased much less rapidly. Finally, the proportion which the customers of municipal plants bears to the total number of customers reported has remained practically unchanged since 1912, at 13.7 per cent, while in 1907 the ratio was 14.6 per cent.

Table 63 shows, in somewhat more detail, for the different divisions and states, the relative importance of commercial and municipal arc and incandescent street lamps. Before discussing these details, however, some attention should be given to the decreased importance of arc lamps in street lighting, as previously mentioned. Thirty-three and eight-tenths per cent of all street lamps were arcs in 1912, whereas in 1917 the proportion had dropped to 15.6 per cent, and no doubt the decrease will continue from year to year. The tungsten and nitrogen-filled incandescents, due in part to their superior efficiency and lower cost of maintenance, but more particularly on account of the greater flexibility of this type of street lighting, have, for economic as well as engineering reasons, displaced the arc lamps. The latter are expensive to install and can be operated with greatest effectiveness only at a high wattage. Hence they would naturally be placed at greater intervals on the public highways, but under such circumstances the needs of the populace are not always so well served. The entire subject of illuminating engineering is technical and complicated, and beyond a doubt the subject of human psychology plays an important part in the matter of street lighting. For example, in order to devise a satisfactory system of lighting for a given municipality or portion thereof, regard must be had to the width and construction of streets and sidewalks, the kind of paving or the color of the same, the height of buildings and the color of the walls must be considered, the height of trees and the density of foliage, the layout of streets—whether they be straight or crooked—the contour of the territory—whether it be level or hilly, etc. In addition, it is necessary to know whether a street is used for residential or business purposes, the nature of the business carried on in different municipalities or in different sections of the same municipality, the general character of the citizens—whether they be native or foreign born; if foreign born, their nationality—and, in some cases, the absence or presence of the liquor traffic may seriously affect the problem. Many other considerations are significant, but from what has been mentioned it should be sufficiently clear that in general incandescent lamps of lower wattage and candlepower can usually be more advantageously placed than the arc lamps for street-lighting purposes.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—NUMBER OF LAMPS USED FOR STREET LIGHTING, BY GEOGRAPHIC DIVISIONS AND STATES: 1917 AND 1912.

Table 63

DIVISION AND STATE.	Census year.	NUMBER OF STREET LAMPS.						PER CENT DISTRIBUTION.			
		Arc.			Incandescent.[1]			Arc.		Incandescent.	
		Total.	Reported by—		Total.	Reported by—		Commercial.	Municipal.	Commercial.	Municipal.
			Commercial stations.	Municipal stations.		Commercial stations.	Municipal stations.				
UNITED STATES	1917	256,950	206,957	49,993	1,383,219	962,908	420,311	80.5	19.5	69.6	30.4
	1912	348,643	264,152	84,491	681,379	474,048	207,331	75.8	24.2	69.6	30.4
GEOGRAPHIC DIVISIONS:											
New England	1917	24,484	23,836	648	184,554	153,363	31,191	97.4	2.6	83.1	16.9
	1912	29,633	26,798	2,835	124,142	96,665	27,477	90.4	9.6	77.9	22.1
Middle Atlantic	1917	77,396	70,918	6,478	322,557	301,025	21,532	91.6	8.4	93.3	6.7
	1912	109,039	100,889	8,150	125,044	116,765	8,279	92.5	7.5	93.4	6.6
East North Central	1917	75,464	45,649	29,815	294,459	147,190	147,269	60.5	39.5	50.0	50.0
	1912	106,688	57,954	48,734	114,419	55,216	59,203	54.3	45.7	48.3	51.7
West North Central	1917	16,324	12,504	3,820	209,560	119,359	90,201	76.6	23.4	57.0	43.0
	1912	24,751	18,073	6,678	102,152	59,734	42,418	73.0	27.0	58.5	41.5
South Atlantic	1917	13,514	9,566	3,948	87,024	50,197	37,427	70.8	29.2	57.3	42.7
	1912	17,679	9,812	7,867	44,142	27,579	16,563	55.5	44.5	62.5	37.5
East South Central	1917	12,098	10,040	2,058	41,023	22,516	18,507	83.0	17.0	54.9	45.1
	1912	15,247	10,766	4,481	18,816	9,755	9,061	70.6	29.4	51.8	48.2
West South Central	1917	12,927	10,385	2,542	51,131	31,308	19,823	80.3	19.7	61.2	38.8
	1912	14,326	11,078	3,248	27,083	18,445	8,638	77.3	22.7	68.1	31.9
Mountain	1917	9,469	9,255	214	46,698	37,556	9,142	97.7	2.3	80.4	19.6
	1912	8,150	7,879	271	23,317	17,532	5,785	96.7	3.3	75.2	24.8
Pacific	1917	15,274	14,804	470	145,613	100,394	45,219	96.9	3.1	68.9	31.1
	1912	23,130	20,903	2,227	102,264	72,357	29,907	90.4	9.6	70.8	29.2
NEW ENGLAND:											
Maine	1917	322	268	54	17,908	12,607	5,301	83.2	16.8	70.4	29.6
	1912	1,411	1,094	317	9,839	7,790	2,049	77.5	22.5	79.2	20.8
New Hampshire	1917	67	67	.....	14,768	13,916	852	100.0	.....	94.2	5.8
	1912	1,482	1,482	.....	9,100	8,584	516	100.0	.....	94.3	5.7
Vermont	1917	356	321	35	9,046	6,489	2,557	90.2	9.8	71.7	28.3
	1912	1,013	709	304	5,563	3,787	1,776	70.0	30.0	68.1	31.9
Massachusetts	1917	16,375	15,872	503	100,441	80,037	20,404	96.9	3.1	79.7	20.3
	1912	17,601	15,834	1,767	67,372	53,124	14,248	90.0	10.0	78.9	21.1
Rhode Island	1917	2,065	2,065	.....	16,202	15,874	328	100.0	.....	98.0	2.0
	1912	3,058	2,993	65	10,640	10,631	9	97.9	2.1	99.9	0.1
Connecticut	1917	5,290	5,243	56	26,189	24,440	1,749	98.9	1.1	93.3	6.7
	1912	5,068	4,686	382	21,628	12,749	8,879	92.5	7.5	58.9	41.1
MIDDLE ATLANTIC:											
New York	1917	20,373	19,139	1,234	156,656	149,333	7,323	93.9	6.1	95.3	4.7
	1912	47,391	44,403	2,988	62,706	58,793	3,913	93.7	6.3	93.8	6.2
New Jersey	1917	13,480	12,628	852	53,052	50,708	2,944	93.7	6.3	94.5	5.5
	1912	16,052	15,561	491	33,708	32,298	1,410	96.9	3.1	95.8	4.2
Pennsylvania	1917	43,543	39,151	4,392	112,249	100,984	11,265	89.9	10.1	90.0	10.0
	1912	45,596	40,925	4,671	28,630	25,674	2,956	89.8	10.2	89.7	10.3
EAST NORTH CENTRAL:											
Ohio	1917	23,498	16,358	7,140	49,042	22,940	26,102	69.6	30.4	46.8	53.2
	1912	30,893	21,234	9,659	20,168	6,888	13,280	68.7	31.3	34.2	65.8
Indiana	1917	11,610	7,491	4,119	45,917	23,591	22,326	64.5	35.5	51.4	48.6
	1912	14,989	10,077	4,912	19,873	9,550	10,323	67.2	32.8	48.1	51.9
Illinois	1917	15,002	11,431	3,571	132,363	59,519	72,844	76.2	23.8	45.0	55.0
	1912	35,399	13,586	21,813	41,065	20,835	20,230	38.4	61.6	50.7	49.3
Michigan	1917	18,102	3,801	14,301	41,365	23,492	17,873	21.0	79.0	56.8	43.2
	1912	16,220	5,310	10,910	22,425	11,688	10,737	32.7	67.3	52.1	47.9
Wisconsin	1917	7,252	6,568	684	25,772	17,648	8,124	90.6	9.4	68.5	31.5
	1912	9,187	7,747	1,440	10,888	6,255	4,633	84.3	15.7	57.4	42.6
WEST NORTH CENTRAL:											
Minnesota	1917	5,565	4,681	884	48,223	28,573	19,650	84.1	15.9	59.3	40.7
	1912	6,495	5,239	1,256	21,776	13,584	8,192	80.7	19.3	62.4	37.6
Iowa	1917	2,394	2,126	268	49,705	32,506	17,199	88.8	11.2	65.4	34.6
	1912	3,637	3,066	571	27,479	17,784	9,695	84.3	15.7	64.7	35.3
Missouri	1917	4,413	3,530	883	30,101	17,529	12,572	80.0	20.0	58.2	41.8
	1912	6,687	4,785	1,902	16,719	8,603	8,116	71.6	28.4	51.5	48.5
North Dakota	1917	497	301	196	11,245	8,506	2,739	60.6	39.4	75.6	24.4
	1912	644	385	259	5,074	3,320	1,754	59.8	40.2	65.4	34.6
South Dakota	1917	611	364	247	7,578	5,065	2,513	59.6	40.4	66.8	33.2
	1912	904	627	277	4,382	3,246	1,136	69.4	30.6	74.1	25.9
Nebraska	1917	178	151	27	27,538	12,543	14,995	84.8	15.2	45.5	54.5
	1912	2,451	1,910	541	12,149	5,883	6,266	77.9	22.1	48.4	51.6
Kansas	1917	2,666	1,351	1,315	35,170	14,637	20,533	50.7	49.3	41.6	58.4
	1912	3,933	2,061	1,872	14,573	7,314	7,259	52.4	47.6	50.2	49.8
SOUTH ATLANTIC:											
Delaware	1917	19	.....	19	1,461	904	557	.....	100.0	61.9	38.1
	1912	91	86	5	1,507	850	657	94.5	5.5	56.4	43.6
Maryland	1917	4,874	4,635	239	11,736	10,195	1,541	95.1	4.9	86.9	13.1
	1912	4,147	3,474	673	9,276	7,508	1,768	83.8	16.2	80.9	19.1
District of Columbia	1917	1,035	1,035	.....	9,093	9,093	.....	100.0	.....	100.0	.....
	1912	1,166	1,166	.....	5,626	5,626	.....	100.0	.....	100.0	.....
Virginia	1917	813	324	489	12,783	6,068	6,715	39.9	60.1	47.5	52.5
	1912	2,513	652	1,861	4,369	2,008	2,271	25.9	74.1	48.0	52.0
West Virginia	1917	2,151	1,305	846	5,017	5,190	427	60.7	39.3	92.4	7.6
	1912	2,096	1,313	783	2,922	2,826	96	62.6	37.4	96.7	3.3
North Carolina	1917	1,545	966	579	11,692	4,391	7,301	62.5	37.5	37.6	62.4
	1912	1,887	835	1,052	5,532	2,045	3,487	44.3	55.7	37.0	63.0

[1] Exclusive of 9,065 street lamps of other varieties in 1917 and 578 in 1912.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—NUMBER OF LAMPS USED FOR STREET LIGHTING, BY GEOGRAPHIC DIVISIONS AND STATES: 1917 AND 1912—Continued.

Table 63—Continued.

DIVISION AND STATE.	Census year.	NUMBER OF STREET LAMPS.						PER CENT DISTRIBUTION.			
		Arc.			Incandescent.[1]			Arc.		Incandescent.	
		Total.	Reported by—		Total.	Reported by—					
			Commercial stations.	Municipal stations.		Commercial stations.	Municipal stations.	Commercial.	Municipal.	Commercial.	Municipal.
SOUTH ATLANTIC—Continued.											
South Carolina	1917	1,348	1,070	278	8,579	3,664	4,915	79.4	20.6	42.7	57.3
	1912	2,196	1,399	797	2,875	1,380	1,495	63.7	36.3	48.0	52.0
Georgia	1917	480	174	306	14,587	3,005	11,582	36.2	63.8	20.6	79.4
	1912	2,370	660	1,710	7,283	1,848	5,435	27.8	72.2	25.4	74.6
Florida	1917	1,249	57	1,192	12,076	7,687	4,389	4.6	95.4	63.7	36.3
	1912	1,213	227	986	4,752	3,398	1,354	18.7	81.3	71.5	28.5
EAST SOUTH CENTRAL:											
Kentucky	1917	6,757	6,343	414	10,832	8,518	2,314	93.9	6.1	78.6	21.4
	1912	7,332	6,263	1,069	5,278	3,896	1,382	85.4	14.6	73.8	26.2
Tennessee	1917	2,861	1,516	1,345	14,068	8,214	6,754	53.0	47.0	54.9	45.1
	1912	3,938	1,888	2,050	6,732	3,172	3,560	47.9	52.1	47.1	52.9
Alabama	1917	1,702	1,506	196	6,983	2,520	4,463	88.5	11.5	36.1	63.9
	1912	2,314	1,652	662	2,805	1,135	1,670	71.4	28.6	40.5	59.5
Mississippi	1917	778	675	103	8,240	3,264	4,976	86.8	13.2	39.6	60.4
	1912	1,663	963	700	4,001	1,552	2,449	57.9	42.1	38.8	61.2
WEST SOUTH CENTRAL:											
Arkansas	1917	1,138	247	891	9,292	5,945	3,347	21.7	78.3	64.0	36.0
	1912	1,045	373	672	4,731	2,837	1,894	35.7	64.3	60.0	40.0
Louisiana	1917	4,295	4,290	5	7,266	3,306	3,960	99.9	0.1	45.5	54.5
	1912	4,474	4,156	318	4,451	2,592	1,859	92.9	7.1	58.2	41.8
Oklahoma	1917	1,925	1,730	195	13,592	6,993	6,599	89.9	10.1	51.4	48.6
	1912	3,303	2,642	661	8,334	4,699	3,635	80.0	20.0	56.4	43.6
Texas	1917	5,569	4,118	1,451	20,981	15,064	5,917	73.9	26.1	71.8	28.2
	1912	5,504	3,907	1,597	9,567	8,317	1,250	71.0	29.0	86.9	13.1
MOUNTAIN:											
Montana	1917	1,966	1,827	139	10,658	9,334	1,324	92.9	7.1	87.6	12.4
	1912	1,560	1,547	13	2,791	2,040	751	99.2	0.8	73.1	26.9
Idaho	1917	924	912	12	6,863	4,978	1,885	98.7	1.3	72.5	27.5
	1912	1,109	1,024	85	3,886	2,535	1,351	92.3	7.7	65.2	34.8
Wyoming	1917	339	339	.....	3,728	3,163	565	100.0	.....	84.8	15.2
	1912	396	376	20	1,168	1,059	109	94.9	5.1	90.7	9.3
Colorado	1917	3,272	3,249	23	10,141	8,963	1,178	99.3	0.7	88.4	11.6
	1912	3,859	3,783	76	7,872	7,073	799	98.0	2.0	89.9	10.1
New Mexico	1917	13	13	.....	2,287	2,001	286	100.0	.....	87.5	12.5
	1912	247	229	18	627	533	94	92.7	7.3	85.0	15.0
Arizona	1917	430	418	12	4,194	4,125	69	97.2	2.8	98.4	1.6
	1912	454	454	.....	1,335	1,335	.....	100.0	.....	100.0	.....
Utah	1917	2,511	2,483	28	7,824	4,086	3,738	98.9	1.1	52.2	47.8
	1912	321	262	59	5,237	2,706	2,531	81.6	18.4	51.7	48.3
Nevada	1917	14	14	.....	1,003	906	97	100.0	.....	90.3	9.7
	1912	204	204	.....	401	251	150	100.0	.....	62.6	37.4
PACIFIC:											
Washington	1917	1,047	701	346	26,466	5,139	21,327	67.0	33.0	19.4	80.6
	1912	2,661	1,016	1,645	20,223	4,986	15,237	38.2	61.8	24.7	75.3
Oregon	1917	489	424	65	10,366	8,116	2,250	86.7	13.3	78.3	21.7
	1912	1,128	1,068	60	6,239	4,721	1,518	94.7	5.3	75.7	24.3
California	1917	13,738	13,679	59	108,781	87,139	21,642	99.6	0.4	80.1	19.9
	1912	19,341	18,819	522	75,802	62,650	13,152	97.3	2.7	82.6	17.4

[1] Exclusive of 9,065 street lamps of other varieties in 1917 and 578 in 1912.

Commercial plants reported 80.5 per cent of all arcs in 1917, whereas in 1912 their proportion of the total number was 75.8 per cent. Only one division, the Middle Atlantic, shows a slight increase in the percentage distribution of arc lamps for municipal plants since 1912. In this division municipal plants reported 8.4 per cent of all arcs, while at the earlier date they returned only 7.5 per cent. In 12 states, however, the municipal plants show an increase in the percentage distribution of arc lamps. The highest percentage of arcs reported, 39.5 per cent, is found in the East North Central division; but 6 states in 1917—Michigan, Delaware, Virginia, Georgia, Florida, and Arkansas—had more municipal than commercial arcs. Further, in 9 states the number of municipal street arc lamps was greater in 1917 than in 1912, while in 5 states—New Hampshire, Rhode Island, Wyoming, New Mexico, and Nevada—municipal plants in 1917 reported no arcs whatever. For commercial plants most states naturally show an increase in the percentage of distribution of arc lamps, due to the fact that the decrease in the number of arc lamps was more rapid for the municipal than for the commercial plants. For this group of plants, the Mountain division shows an actual increase, and 9 states return a greater number of commercial arc lamps than in 1912. These are Massachusetts, Connecticut, Maryland, North Carolina, Kentucky, Louisiana, Texas, Montana, and Utah. The state of Delaware had none in 1917.

So far as incandescent lamps are concerned, the municipal stations reported 30.4 per cent of the total in 1917 as in 1912. In one division, the East North Central, they reported as many lamps as did the

commercial stations. There are, however, 12 states in which the number of municipal incandescents exceeds the number reported by the commercial plants. These states are Washington (80.6 per cent), Georgia (79.4 per cent), Ohio, Illinois, Nebraska, Kansas, Virginia, North Carolina, South Carolina, Alabama, Mississippi, and Louisiana. Five divisions, the West North Central, Middle Atlantic, South Atlantic, West South Central, and Pacific, show a small increase in the relative proportion of incandescents reported by municipal plants, while 23 states also report a more or less marked increase in this respect. All states show an absolute increase in the number of incandescent street lamps reported by the commercial stations, and all, except Connecticut, Delaware, Maryland, and Nevada, in the number reported by municipal stations.

Number and horsepower of stationary motors.—In Table 64 is shown the relative development of the power business of central electric stations in different sections of the United States, together with the rate of increase in the different sections. Owing to the fact, however, that several large commercial plants reported the total horsepower of their motors without giving the number of the same for 1917, it is rather difficult to make satisfactory comparisons with earlier years. As indicated in Table 65, 41 plants, reporting a total motor horsepower of 3,418,090, failed to return the number of their motors. The importance of the major part of these plants is indicated by the fact that the average horsepower of their stationary motors is 83,368, whereas the average for the plants in the United States is only 1,409. It was, of course, possible to make some adjustments for these discrepancies by deducting this horsepower in the various divisions from the total horsepower reported, so that the number of motors appearing in the table would correspond accurately to the horsepower listed. The changes which would result from these deductions have been indicated in parentheses in Table 64, but in studying the revised figures two considerations must be borne in mind. First, while most stations reported the number of their motors served in 1912 and 1907, no doubt in many cases, particularly at the former date, these numbers, so far as the larger commercial plants are concerned, were merely estimates, and consequently little credence can be put in attempted numerical comparisons for this group of plants. In the second place, it is well to remember that many of those larger plants which failed to report the number of motors beyond a doubt served larger motors than did the average station. Hence it is probable that the revised "average capacity" for motors for 1917 is, in many cases, much lower than the actual average. With the information secured, however, no more accurate data are available.

Table 64 CENTRAL ELECTRIC STATIONS—NUMBER AND HORSEPOWER CAPACITY OF STATIONARY MOTORS: 1917, 1912, AND 1907.

DIVISION.[1]	1917		1912		1907		Average capacity.			Per cent of increase in horsepower.			Per cent of total horsepower.		
	Number.	Horsepower.[2]	Number.	Horsepower.	Number.	Horsepower.	1917 [2]	1912	1907	1907–1917	1912–1917	1907–1912	1917	1912	1907
United States	555,924	9,216,330 (5,798,240)	435,473	4,130,619	167,184	1,649,026	16.58 (10.42)	9.49	9.86	458.9	123.1	150.5	100.0	100.0	100.0
New England	101,513	876,600 (819,721)	55,042	391,308	23,841	154,720	8.64 (8.07)	7.11	6.49	466.6	124.0	152.9	9.5	9.5	9.4
Middle Atlantic	157,087	2,596,057 (1,888,939)	124,416	1,213,681	34,108	544,020	16.53 (12.02)	9.76	15.95	377.2	113.9	123.1	28.2	29.4	33.0
East North Central	119,060	1,920,649 (1,061,181)	114,404	799,421	49,345	307,558	16.13 (8.91)	6.99	6.23	524.5	140.2	159.9	20.8	19.4	18.6
West North Central	65,188	757,051 (681,616)	47,540	316,113	19,027	138,027	11.61 (10.45)	6.65	7.25	448.5	139.5	129.0	8.2	7.7	8.4
South Atlantic	19,589	515,293 (318,928)	26,163	361,011	8,948	95,373	26.30 (16.28)	13.80	10.66	440.3	42.7	278.5	5.6	8.7	5.8
East South Central	15,383	138,127 (134,143)	7,592	62,081	3,039	21,656	8.98 (8.72)	8.18	7.13	537.8	122.5	186.7	1.5	1.5	1.3
West South Central	25,684	273,467 (253,793)	15,337	103,765	7,220	42,507	10.65 (9.88)	6.77	5.89	543.3	163.5	144.1	3.0	2.5	2.6
Mountain	21,978	632,439 (278,931)	12,114	235,506	6,091	94,960	28.78 (12.69)	19.44	15.59	566.0	168.5	148.0	6.9	5.7	5.8
Pacific	30,442	1,506,647 (360,988)	32,865	647,733	15,565	250,205	49.49 (11.86)	19.71	16.07	502.2	132.6	158.9	16.3	15.7	15.2

[1] See p. 18 for states composing the several geographic divisions.
[2] Some of the larger stations failed to report the number of stationary motors. Figures in parentheses indicate horsepower represented by the number of motors shown.

It is interesting to note that during the last decade the rate of increase in horsepower of motors for the various divisions has been relatively uniform, though less rapid for the period from 1912 to 1917, 123.1 per cent, as contrasted with 150.5 per cent in the preceding period. Further, those divisions which led the increase between 1907 and 1912—the South Atlantic (278.5 per cent), East South Central (186.7 per cent), and East North Central (159.9 per cent)—were, in the main, superseded by other divisions in the later period. For these years the leaders were the Mountain division (168.5 per cent), the West South Central (163.5 per cent), the East North Central (140.2 per cent), the West North Central (139.5 per cent), and the Pacific (132.6 per cent). Finally, in 1917, as in 1912 and 1907, the Middle Atlantic, East North Central, and Pacific divisions show the largest proportion of the total horsepower, 28.2, 20.8, and 16.3 per cent, respectively, and there has been in the last 10 years comparatively little change in these relative percentages.

Table 65

DIVISION AND STATE.	CENTRAL ELECTRIC STATIONS FAILING TO REPORT NUMBER OF MOTORS BUT REPORTING THE TOTAL HORSEPOWER: 1917.	
	Number of stations reporting no motors.	Horsepower.
United States	41	3,418,090
New England	4	56,879
Vermont	3	3,865
Connecticut	1	53,014
Middle Atlantic	6	707,118
New York	3	524,006
Pennsylvania	3	183,112
East North Central	4	859,468
Illinois	3	858,031
Wisconsin	1	1,437
West North Central	4	75,435
Iowa	1	15,127
Missouri	1	38,413
Kansas	2	21,895
South Atlantic	9	196,365
Maryland	1	149,507
District of Columbia	1	29,150
Virginia	1	200
North Carolina	2	14,693
South Carolina	4	2,815
East South Central	1	3,984
Tennessee	1	3,984
West South Central	3	19,674
Arkansas	1	1,091
Louisiana	1	3,851
Texas	1	14,732
Mountain	3	353,508
Montana	2	234,640
Utah	1	118,868
Pacific	7	1,145,659
California	7	1,145,659

Averages per station, etc.—Table 66 had been prepared in order to show the comparative averages in line equipment for commercial and municipal stations in the three census periods 1917, 1912, and 1907. From this table, also, can be readily deduced the rate of growth per station in the various significant items. It will be noted that the per cent of decrease in the average number of arc lamps per station since 1912 has been about 32 per cent for commercial plants and 60 per cent for municipal plants. It is further surprising to find that in 1912 the average number of street incandescent lamps per station was greater for municipal (133) than for commercial plants (130). This, of course, confirms the previous suggestion that, relative to the amount of population served, municipal plants are much more generous with their street lighting, though, of course, it should be remembered that the wattage of the municipal street lamps may sometimes be lower than that of the commercial lamps. On this point, however, it was scarcely feasible to secure statistics, nor was the estimated amount of current used for street lighting called for separately in the schedule. By 1917 the average had increased for the commercial plants by 75.4 per cent to 228 per station, while for municipal plants the increase had been only 36.1 per cent to 181 per station.

Table 66

ITEM.	Census year.	COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—LINE EQUIPMENT, AVERAGE PER STATION.		
		Total.	Commercial.	Municipal.
Street lamps:				
Average number of arcs per station	1917	39	49	22
	1912	67	72	54
	1907	(1)	(1)	(1)
Average number of incandescent lamps per station.	1917	211	228	181
	1912	131	130	133
	1907	(1)	(1)	(1)
Meters on consumption circuits:				
Average number per station	1917	1,086	1,461	401
	1912	693	860	301
	1907	357	424	172
Ratio of meters to customers (per cent)	1917	98.9	99.5	95.3
	1912	94.3	95.0	89.4
	1907	86.5	88.3	75.9
Stationary motors:				
Average number per station	1917	85	120	22
	1912	83	113	14
	1907	35	47	4
Average horsepower per station	1917	1,409	2,081	184
	1912	791	1,084	105
	1907	350	467	25
Average horsepower per motor	1917	17	17	8
		[2](12)	[2](11)	
	1912	10	10	8
	1907	10	10	7
Ratio of customers to population of districts served (per cent)	1917	[3] 11.4	11.0	7.1

[1] Figures not available.
[2] Adjusted to cover only those plants which made complete returns.
[3] Duplicated population eliminated.

The number of meters on consumption circuits has during both five-year periods increased with far greater rapidity for commercial stations, more than doubling between 1907 and 1912, and increasing about 70 per cent in the last five-year period. For municipal plants, on the other hand, the growth during the earlier period was only 75 per cent, and between 1912 and 1917 only 33.2 per cent. During the latest five-year period the growth in number of meters has been practically coextensive with the growth in the number of customers. In 1917 the average number of customers per commercial station was 1,461 and for municipal stations 401. It is further interesting to note in this connection that, even at the present time, the commercial plants have a considerable advantage over municipal plants in the matter of metered current, the ratio of meters to customers being 99.5 per cent for the former and only 95.3 per cent for the latter. The disparity, however, was much greater in 1907, when for the commercial plants the ratio was 88.3, while for municipal plants it was only 75.9. In other words, at this date probably not more than three-fourths of the customers of municipal plants were supplied with meters.

In the matter of stationary motors some rather surprising facts are shown in this table. The average number per commercial station in 1917 was 120, an increase of only 6.2 per cent since 1912. The growth for municipal plants since 1912 has been much more rapid (57.1 per cent), but the absolute number of motors per station is, for commercial plants, five and one-half times as great as for municipal plants (22).

More significant is the condition indicated relative to the average horsepower of motors per station. It is found from the figures that not only has the growth in average horsepower since 1912 been more rapid for commercial plants (92 per cent) than for municipal plants (75.2 per cent), but the average horsepower for the former (2,081) is over eleven times as great as the average (184) for municipal plants. Finally, the average horsepower per motor for commercial stations making full reports has increased from 10 in 1912 to 11 in 1917, while for municipal plants it has remained the same, 8 in both years.

The ratio of customers to the population of districts served is, as might be expected, much greater for commercial stations (11 per cent) than for municipal plants (7.1 per cent), the larger proportion of which are located in the smaller population groups. Not only do commercial plants have as customers a proportion of the inhabitants of their territory which is more than 50 per cent greater than the proportion reported by municipal plants, but on the average they also supply these customers with a far higher amount of current. Earlier figures given indicate that the amount of current actually supplied for lighting by commercial plants averages 717 kilowatt hours per customer reported, while the average for municipal plants is 683 kilowatt hours. These figures, of course, do not actually represent the number of kilowatt hours consumed for light per individual customer, since a large proportion of lighting service is covered by street lighting, public-building lighting, and similar service other than domestic. The relative conditions in this regard, however, are presumably about the same in the two groups of plants. In the matter of power service per customer a very wide difference is found between commercial and municipal plants. The former supply an average of 2,069 kilowatt hours for power per customer reported, while the latter supply only 350 kilowatt hours, or about one-sixth as much. Again, these figures must be taken with caution, in view of the fact that probably a relatively small proportion of all customers reported by either group are supplied with power. The data, however, are of considerable interest.

Subsidiary equipment.—The data contained in Table 67 are of no great public interest. The great excess of subsidiary equipment reported by commercial plants over the amount of such equipment reported by municipal stations is to be expected, in view of the far greater size of the former, as well as in view of the fact that the latter have practically no substations. It is, however, interesting to find that electric railways return more than half the rotary converters and motor generator sets, both in number and kilowatt capacity, while the proportion of transformers in stations and substations for the street railways is also extraordinarily large as compared with that of the central stations. The average capacity per transformer, however, is higher for the central electric stations, 431 kilowatts, than for the electric railways, 340 kilowatts. For the commercial stations, also, the average capacity of 454 kilowatts per transformer is 148 per cent greater than the average capacity per transformer for the municipal stations (183 kilowatts). This, however, is natural on account of the relatively smaller generating units of the latter.

Table 67 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—SUBSIDIARY EQUIPMENT.

	Census year.	Rotary converters and motor generator sets.[1]		Boosters.		Transformers.	
		Number.	Kilowatt capacity.	Number.	Kilowatt capacity.	Number.	Kilowatt capacity.
Total	1917	6,048	4,237,935	512	76,725	31,273	12,635,943
	1912	4,667	2,646,396	511	47,028	22,304	6,461,336
	1907	2,532	1,305,651	261	21,856	11,062	2,826,693
Central stations	1917	2,659	1,898,602	374	50,208	22,046	9,499,006
	1912	1,827	1,009,136	328	22,821	13,868	4,103,939
	1907	670	363,419	127	4,810	5,788	1,693,532
Commercial	1917	2,585	1,884,501	353	49,464	20,174	9,155,798
	1912	1,781	996,531	295	20,151	12,972	4,039,236
	1907	665	362,706	106	4,474	5,479	1,677,682
Municipal	1917	74	14,101	21	744	1,872	343,208
	1912	46	12,605	33	2,670	896	64,703
	1907	5	713	21	336	309	15,850
Electric railways	1917	3,389	2,339,333	138	26,517	9,227	3,136,937
	1912	2,840	1,637,260	183	24,807	8,436	2,357,397
	1907	1,862	942,232	134	17,046	5,274	1,133,161

[1] In 1907 motor generator sets were not included.

Finally, it may be worth while to mention that the total number of auxiliary generators reported for the two groups of plants, 338, with a total capacity of 34,623 kilowatts, is too small to be of any significance, nor is it altogether certain just what kind of units were reported under this head.

In the matter of storage batteries, also, the total number of cells reported was 113,452, with a total capacity in ampere hours of 1,271,243. Of this amount practically the entire capacity, or 1,252,440 ampere hours, was reported by commercial plants, which returned a total of 106,484 cells. This left the municipal plants with only 6,968 cells and the insignificant capacity of 18,803 ampere hours. While it is true that some small stations, both municipal and commercial, particularly in the West North Central states, reported a considerable number of storage batteries of an inexpensive type, which were used to carry the "light load" in the daytime when the dynamos were not operated, yet by far the greater amount, both in number and capacity, were reported by the very large commercial stations, which frequently store a considerable amount of current to be used in cases of emergency resulting from the possible breakdown of a portion of their generating system. On account of the very high cost of large storage batteries, only the more important plants can afford to install them.

CHAPTER VIII.—FINANCIAL STATISTICS.

CAPITAL.

The balance sheet.—Owing to the lack of uniformity in accounting systems as well as to the differences which exist in the matter of public regulation of central electric stations in the different states, it is difficult to secure satisfactory balance sheets from all plants. Some have their own accounting systems developed with a view to meeting their particular needs, and they find it difficult to readjust the various items in conformity to the census requirements. Others, particularly the smaller stations, do not keep their books in sufficient detail to enable them to return satisfactory replies to all inquiries. In the case of composite plants, also, it is sometimes an extremely difficult matter to make a satisfactory segregation of any of the items on the balance sheet, though in practically all cases reasonable estimates have been secured when absolute figures were not available.

So far as the commercial stations are concerned, the balance sheets of the numerous large plants are so important as to reduce to a negligible quantity any *inconsistencies which may have appeared in the* accounts of the smaller plants. Great difficulty, however, was experienced at this census, as well as at the earlier periods, in securing from the majority of municipal plants data which would conform to the census requirements. As a large number of states do not attempt any kind of commission regulation of publicly owned stations, and since, even when commission regulation does exist, the requirements are frequently not so specific for municipal stations as for the companies, it frequently happens that the accounts of these plants are almost hopelessly involved and combined with the general accounts of the municipality which owns them. Hence, in spite of all efforts which have been made to obtain correct figures, it is probable that the data covering municipal plants are not so trustworthy as those secured from the commercial stations.

For 1917, in addition to the items on the 1912 schedule, a call was made for the value of "other physical property," which supposedly includes discarded portions of plant and equipment, and in some cases office supplies and fixtures, etc., none of which are a part of the active *electric* plant, but which were no doubt included in the value of plant and equipment in 1912. "Cash and notes and accounts receivable" have also been separated from "materials and supplies," while an entry was also made for "interest, dividends, and rents receivable." Under "Liabilities" a similar new item appears in "premium on capital stock and funded debt."

Table 68 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—COMPARATIVE BALANCE SHEETS: 1917.

ITEM.	Commercial.		Municipal.	
	Amount.	Per cent of total.	Amount.	Per cent of total.
Total assets or liabilities	$3,631,973,213	100.0	$148,345,165	100.0
ASSETS.				
Value of plant and equipment	2,933,016,941	80.8	127,375,200	85.9
Other physical property	31,216,857	0.9	2,626,531	1.8
Stocks and bonds of other electric companies	120,525,114	3.3	.....	.....
Stocks and bonds of companies other than electric companies	60,407,516	1.7	60,869	(1)
Treasury securities	66,665,218	1.8	208,254	0.1
Other permanent investments	25,725,283	0.7	1,279,472	0.9
Cash and notes and accounts receivable	174,565,669	4.8	8,737,386	5.9
Materials and supplies	58,496,656	1.6	3,281,215	2.2
Stock and bond discount	61,528,787	1.7	25,786	(1)
Sinking and other special funds	23,256,366	0.6	2,784,285	1.9
Interest, dividends, and rents receivable	4,340,555	0.1	14,427	(1)
Sundries	53,030,040	1.5	1,297,945	0.9
Profit and loss deficit for stations showing a deficit	10,198,211	0.3	653,795	0.4
LIABILITIES.				
Capital stock	1,560,251,265	43.0	.....	.....
Funded debt	1,297,319,859	35.7	54,973,742	37.1
Cash investment	16,057,957	0.4	51,791,104	34.9
Real estate mortgages	15,236,581	0.4	174,309	0.1
Floating debt	203,030,128	5.6	3,490,033	2.4
Reserves	164,865,402	4.5	7,294,905	4.9
Bills and accounts payable	101,709,863	2.8	2,297,286	1.5
Interest, rents, and taxes due and accrued	38,633,405	1.1	1,886,405	1.3
Dividends due and payable, but unpaid	5,265,314	0.1	.....	.....
Premium on capital stock and funded debt	25,914,108	0.7	86,528	0.1
Sundries	27,722,329	0.8	626,099	0.4
Profit and loss surplus for stations showing a surplus	175,907,002	4.8	25,724,749	17.3
Net surplus	165,768,791	.....	25,070,954	.....

[1] Less than one-tenth of 1 per cent.

In Table 68 are shown the comparative relations which existed between the balance sheets of commercial and municipal central electric stations in 1917. Naturally a number of items which apply to commercial stations can not be returned by municipal plants which do not do a general financing business, and which secure their funds from the issue of bonds or from the tax levy instead of by means of stock issues. Probably no particular comment needs to be made on the figures here presented, as several of the important items will be discussed in detail in the following pages. Mention should, however, be made of the fact that municipal stations reported 1.9 per cent of their assets in sinking and other special funds, which, relative to the investment in plant and equipment, is much greater than the amount reported by commercial stations. This is due to the common practice on the part of municipalities of establishing sinking funds, sometimes created out of earnings and sometimes resulting from appropriations from the tax levy, for

the purpose of paying off their bonds at maturity. Companies, on the other hand, usually refund their indebtedness. It further appears that a certain number of commercial stations, 691, or 16.4 per cent of the total number, reported a profit and loss deficit of $10,198,211. There were also 274 municipal plants, 11.8 per cent of the total number, which showed a deficit of $653,795.

Among the liabilities it is found that the commercial plants have a relatively greater amount of floating debt and real estate mortgages outstanding than have the other group. The cash investment in municipal stations, however, equal to 34.9 per cent of the total liabilities, is extremely important, and represents roughly the amount which has been put into the property out of earnings or from the tax levy. For commercial stations this small item, four-tenths of 1 per cent of all liabilities, represents in general the investment in stations which are operating under the individual or partnership form of management.

Attention should finally be called to the fact that while commercial stations reported a profit and loss surplus of $175,967,002, or 4.8 per cent of their total liabilities, municipal stations claim a surplus of $25,724,749, or 17.3 per cent of all liabilities. In the former the net surplus amounts to 5.7 per cent of the value of plant and equipment and in the latter to 19.7 per cent. There is only one way of building up a surplus in the case of a commercial plant, namely, out of earnings from year to year. Municipal stations, however, frequently keep their books in such a way that appropriations made from the general tax levy, either for paying off bonds and notes at maturity or for original or new construction, are improperly recorded, so that when the debt liabilities are reduced there appears to be an increase in the profit and loss surplus instead of in the cash investment, as would be proper under the circumstances. It is therefore scarcely probable that after all the ordinary expenses of operation have been met so large a surplus has actually been built up out of annual earnings.

Capitalization.—The total capitalization of the commercial stations may be regarded as the sum of all the stock and interest-bearing obligations outstanding, together with the premium on capital stock and on bonds, as well as the cash investment in unincorporated plants. It is also possible to arrive at the apparent capitalization of municipal plants by the same process, though on account of the methods of accounting previously referred to the resultant figures are by no means a true index of the capital investment. Accordingly, it has been thought more satisfactory to use the reported investment in plant and equipment in the case of municipal stations.

As shown in Table 69, the gross capitalization of the electric light and power industry in the United States is $3,245,185,098, of which amount $127,375,200, or 3.9 per cent, represents the investment in municipal stations. The principal items entering into this total for commercial stations are capital stock, amounting to exactly 50 per cent of their capitalization; bonds, to the extent of 41.7 per cent; and floating debt, amounting to 6.5 per cent. Cash investments, real estate mortgages, and premium on securities issued amount together to only 1.8 per cent. However, the total capitalization of $3,117,809,898, indicated for commercial stations, is subject to some reduction. In order to arrive at the net capitalization for the electric light and power business alone it is necessary to deduct not only the amount of stock and bonds of other electric companies which are held, but also the securities of companies other than electric, as well as treasury securities, and other permanent investments outside the electric light and power industry. This makes necessary a total deduction of $313,539,988, leaving a net capitalization of $2,804,269,910, which is equivalent to 95.6 per cent of the reported investment in plant and equipment.

Table 69 CENTRAL ELECTRIC STATIONS—CAPITALIZATION.

	Amount.		Per cent of total—Commercial stations.	
	1917	1912	1917	1912
Total	$3,245,185,098	$2,289,622,199	.....	.....
Commercial stations:				
Capital stock	1,560,251,205	1,154,587,016	50.0	52.2
Common	1,278,887,492	977,639,057	.....	.....
Preferred	271,051,913	176,947,959	.....	.....
Debenture	10,311,800	(1)	.....	.....
Funded debt	1,297,319,859	897,907,681	41.7	40.6
Floating debt	203,030,128	137,726,385	6.5	6.2
Cash investments	16,057,957	12,165,075	0.5	0.5
Real estate mortgages	15,236,581	10,170,898	0.5	0.5
Premium on capital stock and funded debt	25,914,108	(1)	0.8	.....
Total	3,117,809,898	2,212,557,055	100.0	100.0
Deduct intercompany holdings and treasury securities	196,190,332	126,305,618	.....	.....
Net capital	2,921,619,566	2,086,251,437	.....	.....
Deduct investments outside of electric light and power industry	117,349,656	76,721,716	.....	.....
Net capital based on electric light and power industry	2,804,269,910	2,009,529,721	.....	.....
Municipal stations: Value of plant and equipment	127,375,200	77,065,144	.....	.....

(1) Not reported.

While the indicated capitalization of municipal plants has not been used in Table 69, it may be of some interest to present the figures for 1917 and 1912, and this is done in Table 70.

Table 70 CAPITALIZATION OF MUNICIPAL CENTRAL ELECTRIC STATIONS: 1917 AND 1912.

	1917	1912	Per cent of total.	
			1917	1912
Total	$110,515,721	$63,558,310	100.0	100.0
Funded debt	54,973,742	31,189,357	49.7	49.1
Premium on funded debt	86,528	.....	0.1	.....
Floating debt	3,490,038	4,959,382	3.2	7.8
Real estate mortgages	174,309	344,608	0.2	0.5
Cash investment	51,791,104	27,064,963	46.9	42.6

The total for funded debt, including premiums on the same, floating debt, real estate mortgages, and cash investments, in 1917 was $110,515,721, or 86.8 per cent of the total value of plant and equipment reported. In 1912 the corresponding figures were $63,558,310, or 82.5 per cent of the value of plant and equipment. There has been a marked decrease since 1912 in the relative importance of floating debt, from 7.8 per cent to only 3.2 per cent. There has, however, been an almost correlative increase in the proportion of capitalization which is represented by cash investment, from 42.6 per cent in 1912 to 46.9 per cent in 1917. Almost half of the capitalization, however, was at the two dates represented by bonds.

Capital stock and funded debt of incorporated commercial stations.—A brief reference should be made to the increase in capital stock and bonds shown by commercial companies since 1907. These are the more stable items in the balance sheet, as they are rarely if ever subject to decrease. Cash investments, real estate mortgages, floating debt, etc., are, on the other hand, constantly fluctuating.

Table 71 COMMERCIAL COMPANIES—CAPITAL STOCK, FUNDED DEBT, AND DIVIDENDS: 1917, 1912, AND 1907.

	1917	1912	1907	Per cent of increase.		
				1907–1917	1912–1917	1907–1912
Number of commercial companies having outstanding capitalization	[1] 2,785	[2] 2,663	[3] 2,516	10.7	4.6	5.8
Total capitalization outstanding	$2,857,571,124	$2,052,494,697	$1,341,995,182	112.9	39.2	52.9
Capital stock	1,560,251,265	1,154,587,016	741,317,497	110.5	35.1	55.7
Common	1,278,887,492	977,636,057	606,003,772	92.0	30.8	46.8
Preferred	271,051,913	176,947,959	75,313,725	259.9	53.2	134.9
Debenture	10,311,860	[4]	[4]			
Funded debt	1,297,319,859	897,907,681	600,677,685	116.0	44.5	49.5
Dividends, amount	64,589,321	34,580,872	19,300,572	234.6	86.8	79.2
On common stock	52,326,438	28,602,399	16,883,812	209.9	82.9	69.4
On preferred stock	12,262,883	5,978,473	2,416,760	407.4	105.1	147.4

[1] Exclusive of the capitalization of 160 electric railways which operated electric light and power departments, and 133 central electric stations not reporting stock and bonds for sundry reasons, but including 52 stations whose capitalization was reported by other stations, and 32 stations reporting bonds only.
[2] Exclusive of the capitalization of 169 electric railways which operated electric light and power departments, and 116 central electric stations not reporting stock and bonds for sundry reasons, but including 18 stations whose capitalization was reported by other stations, and 23 stations reporting bonds only.
[3] Exclusive of 37 companies (21 operating electric railways with capitalization included in report for street and electric railways; 9 corporations reporting capitalization in one state and owning establishments in another state, which are reported separately in certain of the tables; and 7 not reporting capitalization for sundry reasons), but including 2 companies reporting bonds only, their capital stock not being separable from that representing other interests.
[4] Not reported.

From Table 71 it appears that there has been little change in the actual number of companies having outstanding capitalization, the increase being only 10.7 per cent during the decade and 4.6 per cent during the past five years. The total capitalization during the same periods has increased 112.9 per cent and 39.2 per cent, respectively. Upon examining the various items further we find that the funded debt has, during the past five years as well as during the decade, increased more rapidly than the stock issues, though between 1907 and 1912 the capital stock grew more rapidly than the bonds outstanding. Between 1912 and 1917 there was an increase of only 35.1 per cent in all capital stock and of 44.5 per cent in funded debt. During this period, also, the preferred stock issues showed an increase of 53.2 per cent as opposed to a gain of only 30.8 per cent for the common stock. These figures no doubt point to the fact that it has within the past few years been increasingly difficult to secure capital for investment in public-utility enterprises unless a very definite guaranty of a fair return is made. Hence the preference for bonds and preferred stock, which appeal to the cautious investor. It is, however, interesting to note that the total amount of dividends paid on outstanding stock has at all periods increased more rapidly than has the par value of the stock issued. This fact indicates an increasingly higher rate of dividend for those companies which actually paid dividends at the various dates. This condition is clearly indicated in Table 72, which shows the rates of dividend paid on all stock as well as on the common and the preferred at the four census periods.

Table 72 RATE OF DIVIDENDS PAID ON CAPITAL STOCK OF COMMERCIAL COMPANIES.

	1917	1912	1907	1902
All stock	4.1	3.0	2.6	1.7
Common	4.1	2.9	2.5	1.6
Preferred	[1] 4.5	3.4	3.2	2.6

[1] Includes interest on debenture stock.

From Table 72 it can be seen that the average rate was highest in 1917, 4.1 per cent on the common stock and 4.5 per cent on the preferred, and that the increase in rate has been most rapid since 1912. The rate of dividend on the reported value of plant and equipment was, however, equal to only 2.2 per cent in 1917 and 1.6 per cent in 1912. Also, it should be noted that by no means all of the common or even of the preferred stock paid dividends during 1917. In this year there were 1,976 companies which paid no dividends whatever. These, of course, were mostly small concerns, but they comprise 67.8 per cent of the total number of incorporated central electric stations and 71 per cent of all which have outstanding capitalization.

Value of plant and equipment.—It is a difficult matter indeed in a census of this kind to secure wholly accurate data as to the actual value of central-station property in the United States. Some plants carry on their books the entire cost of their property to the year covered by the present report. Others report the depreciated value, estimated according to local standards and conditions. Some stations, again, report the actual purchase cost of the property from former holders, while in many cases the value is utterly unknown and the figures are merely the crudest estimates.

In addition to these difficulties it should be noted that some companies include many intangible items in the valuation in addition to the actual physical property used. Good-will franchises of different sorts, prospective earnings, and other items frequently find their way into the book value of the plant. Further, regard must be had to local conditions and to the nature of business and the physical organization of each plant. One which always has purchased its current will normally have a relatively low investment in proportion to the amount of business done. On the other hand, a purchasing plant which formerly generated current may have a large investment in unused generating equipment of different kinds which will cause the value to appear unduly high. A plant doing an extensive lighting business will find it necessary to put a great deal of money into service lines, meters, transformers, etc., which would not be needed in the case of a larger plant engaged primarily in the business of supplying current for power. Again, the legitimate investment differs widely in accordance with the nature of primary power used. A water-power plant, which is ordinarily operated at a very low cost per kilowatt hour, usually requires a relatively high investment for developmental purposes. Expensive storage dams must frequently be constructed, water-power rights secured, and considerable portions of land bought, which, while not actually a part of the plant and equipment, are yet a perfectly justifiable investment, and without which it would be impossible to install and operate the plant. Finally, such stations frequently equip themselves with a view to future rather than merely present needs, and install more primary power equipment than is required to operate their dynamos. For all of these reasons a comparatively high investment can be looked for in this group of stations.

Finally, as previously mentioned, it must be borne in mind that probably in most cases no satisfactory general comparison can be made between the investment in municipal plants and the investment in commercial plants. The former, almost without exception, confine their services to a restricted area, furnishing current only to the municipality in which they are located. The latter serve many different municipalities, varying from the average of almost 3 per station to as high as 150 or 200 in some cases. This means that they have a heavy investment in distribution lines, frequently far in excess of the investment in their central generating stations. Many municipal plants confine their activities pretty largely to the supply of current for street lighting and for municipal power, and consequently do not incur the numerous investments which must be made in order to serve a wide variety of customers acceptably. Not only does it frequently happen that no separate record of the value of municipal plants is kept, but also there appears to be a disposition on the part of many municipal officials in their accounting to lose sight of the investments which have been made in their plants by means of appropriations from the tax levy or through reinvested earnings. Finally, it should be recalled that, as pointed out in a preceding chapter, the municipal plants report a relatively high proportion of antiquated equipment as compared with commercial stations—a fact which probably indicates that they have made an attempt to economize on their capital outlays. Whether similar economies have been attempted in the matter of station construction, etc., it is impossible to state, though there is a strong probability that this is true. For these reasons it is to be expected that investment accounts of municipal plants, even granting that conditions of operation were similar, which is in general not the case, would be somewhat lower than for commercial stations.

Perhaps attention should further be called to the fact that, whereas at preceding censuses the *cost* of plant and equipment was called for, the schedules for 1917 ask for the *value* of plant and equipment. It may of course be possible in some cases that the book value for various reasons will be higher than the actual cost of the plant. It is generally true, however, that the value is somewhat lower than the cost. Hence it is to be expected that the 1917 figures may show a less marked growth than might have been looked for had the method of reporting been the same as that used at earlier dates. Most of the items included under "other physical property," also, were no doubt reported in 1912 and at earlier periods under "cost of plant and equipment."

In Table 73 is presented a comparative summary, by geographic divisions and states, of the investment accounts of commercial and municipal plants at the last three census periods, together with the per cent of increase, per cent of total, and per cent distribution. The greatest investment in commercial stations in 1917, as at the two preceding periods, is found in the Middle Atlantic, East North Central, and Pacific divisions. Municipal stations report the highest investment in the East North Central division ($49,201,395), followed after a wide gap by the West

North Central, the Pacific, and the South Atlantic divisions. Among the different states New York leads, with an investment in commercial plants of $415,608,131; California reports $371,753,554, followed by Pennsylvania ($254,873,397), Illinois ($200,930,032), Massachusetts ($124,798,808), and Michigan ($122,703,011). No other states report as much as $100,000,000. Those states ranking highest in municipal plant investment are Illinois ($21,499,414), California ($9,816,091), Michigan ($9,698,401), Ohio ($9,172,571), Washington ($7,854,363), Indiana ($5,632,266), and Kansas ($5,544,042). The remainder report less than $5,000,000 investment, while the lowest amount is to be found in Nevada ($25,431) and Rhode Island ($30,000). The lowest investments in commercial plants are found in Mississippi ($3,166,048), Wyoming ($4,118,002), and New Mexico ($4,120,622).

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—VALUE OF PLANT AND EQUIPMENT: 1917, 1912, AND 1907.

Table 73

DIVISION AND STATE.	TOTAL.			COMMERCIAL.			MUNICIPAL.		
	1917	1912	1907	1917	1912	1907	1917	1912	1907
UNITED STATES	$3,060,392,141	$2,175,678,266	$1,096,913,622	$2,933,016,941	$2,098,613,122	$1,054,034,175	$127,375,200	$77,065,144	$42,879,447
GEOGRAPHIC DIVISIONS:									
New England	244,925,811	153,468,258	92,582,350	237,951,257	147,947,181	88,230,999	6,974,554	5,521,077	4,351,351
Middle Atlantic	773,905,743	584,107,361	391,858,983	767,740,027	580,011,561	388,371,339	6,165,116	4,095,800	3,487,644
East North Central	577,427,830	388,575,873	203,859,358	528,226,444	357,102,214	186,793,279	49,201,395	31,473,659	17,066,079
West North Central	319,259,184	170,306,935	86,378,753	298,840,441	159,568,592	80,489,670	20,418,743	10,738,343	5,889,083
South Atlantic	184,366,719	134,310,186	58,513,594	172,639,749	127,176,089	54,437,552	11,726,970	7,134,097	4,076,042
East South Central	137,565,679	74,964,574	27,384,959	132,457,183	70,769,454	24,629,956	5,108,496	4,195,120	2,755,003
West South Central	111,225,153	76,052,774	31,981,172	104,424,832	71,991,145	30,477,054	6,800,321	4,061,629	1,504,118
Mountain	264,360,303	203,195,798	57,380,775	261,928,362	201,965,269	56,829,573	2,431,941	1,230,529	551,202
Pacific	447,355,710	390,696,507	146,973,678	428,808,046	382,081,617	143,774,753	18,547,664	8,614,890	3,198,925
NEW ENGLAND:									
Maine	28,274,341	19,926,292	12,629,101	27,872,766	19,687,956	12,443,798	401,575	238,336	185,303
New Hampshire	20,564,802	18,061,576	8,695,652	20,384,067	17,905,032	8,618,803	180,735	156,544	76,849
Vermont	15,722,879	10,027,600	7,234,498	14,628,325	9,277,420	6,652,907	1,094,554	750,180	581,591
Massachusetts	128,935,843	71,707,238	43,279,226	124,798,808	68,395,610	40,523,245	4,137,035	3,311,628	2,755,981
Rhode Island	17,703,309	11,339,294	7,327,892	17,673,309	11,330,919	7,295,943	30,000	8,375	31,949
Connecticut	33,724,637	22,406,258	13,416,011	32,593,982	21,350,244	12,696,303	1,130,655	1,056,014	719,708
MIDDLE ATLANTIC:									
New York	418,137,847	350,529,904	252,731,789	415,608,131	348,696,341	251,199,662	2,529,716	1,830,563	1,532,127
New Jersey	98,202,758	69,058,331	65,219,445	97,259,099	68,669,160	64,961,012	943,659	389,221	258,433
Pennsylvania	257,565,138	164,522,076	73,907,749	254,873,397	162,646,060	72,210,665	2,691,741	1,876,016	1,697,084
EAST NORTH CENTRAL:									
Ohio	97,827,744	69,243,894	42,557,000	88,655,173	64,625,010	39,132,506	9,172,571	4,618,884	3,424,494
Indiana	62,463,212	47,930,252	25,680,710	56,830,946	43,747,700	23,427,532	5,632,266	4,182,552	2,253,178
Illinois	222,429,446	162,104,226	88,142,233	200,930,032	147,782,820	82,195,708	21,499,414	14,321,406	5,946,525
Michigan	132,401,412	72,764,830	37,001,000	122,703,011	66,285,610	32,656,235	9,698,401	6,479,220	4,344,825
Wisconsin	62,306,025	36,532,671	10,478,355	59,107,282	34,661,074	9,381,298	3,198,743	1,871,597	1,097,057
WEST NORTH CENTRAL:									
Minnesota	78,143,330	44,360,910	24,138,081	73,631,897	41,767,683	22,192,753	4,511,433	2,593,227	1,945,328
Iowa	83,693,734	22,126,518	9,986,666	80,159,582	20,555,159	8,955,989	3,534,152	1,571,359	1,032,677
Missouri	68,271,685	48,624,710	33,865,760	65,645,584	46,350,586	32,554,571	2,626,101	2,274,124	1,311,189
North Dakota	8,006,632	4,881,632	1,619,997	7,562,839	4,598,964	1,474,985	443,793	282,668	145,012
South Dakota	14,923,220	11,318,041	2,806,303	14,111,604	10,985,158	2,007,668	811,616	332,883	198,695
Nebraska	30,022,944	12,971,316	7,372,081	27,075,338	11,565,718	6,863,096	2,947,606	1,405,598	508,985
Kansas	36,197,639	26,023,808	6,889,805	30,653,597	23,745,324	5,842,608	5,544,042	2,278,484	747,197
SOUTH ATLANTIC:									
Delaware, Maryland, and District of Columbia	44,015,770	39,970,422	34,010,868	43,315,047	39,527,113	33,662,977	700,723	443,309	347,891
Virginia	25,690,743	10,927,379	1,790,271	23,941,401	9,517,318	1,338,257	1,749,342	1,410,061	452,014
West Virginia	17,240,227	13,360,173	2,682,935	17,089,102	13,280,643	2,582,063	151,125	109,530	100,872
North Carolina	35,563,149	12,090,231	2,241,791	33,171,640	10,722,951	1,425,512	2,391,509	1,367,280	816,279
South Carolina	30,626,080	34,012,368	8,803,382	29,669,573	33,436,891	8,390,856	956,507	575,477	412,526
Georgia	22,709,945	19,890,925	7,354,286	20,107,602	18,344,251	6,226,602	2,602,343	1,546,674	1,127,684
Florida	8,520,805	4,028,688	1,630,061	5,345,384	2,346,922	811,195	3,175,421	1,681,766	818,866
EAST SOUTH CENTRAL:									
Kentucky	32,714,330	19,709,023	10,356,088	31,769,695	19,025,541	9,831,444	944,635	683,482	524,644
Tennessee	63,351,995	41,517,416	7,514,333	61,695,407	39,953,142	6,672,899	1,656,588	1,564,274	841,434
Alabama	36,797,899	8,726,776	7,203,876	35,826,033	7,975,241	6,804,059	971,866	751,535	489,817
Mississippi	4,701,455	5,011,359	2,220,662	3,166,048	3,815,530	1,321,554	1,535,407	1,195,829	899,108
WEST SOUTH CENTRAL:									
Arkansas	10,487,729	4,811,879	1,922,658	9,535,869	4,242,013	1,505,602	951,860	569,866	417,056
Louisiana	17,176,497	14,275,269	11,614,121	15,803,842	13,693,106	11,137,261	1,372,655	582,163	476,860
Oklahoma	23,528,513	13,352,640	7,130,864	20,806,650	11,697,726	6,928,514	2,721,863	1,654,914	202,350
Texas	60,032,414	43,612,986	11,313,529	58,278,471	42,358,300	10,905,677	1,753,943	1,254,686	407,852
MOUNTAIN:									
Montana	85,607,527	64,583,301	17,950,677	85,295,039	64,441,739	17,903,167	312,488	141,562	47,510
Idaho	28,376,832	32,482,566	3,251,460	27,875,340	32,245,940	3,203,567	501,492	236,626	47,893
Wyoming	4,224,780	2,200,032	942,326	4,118,002	2,167,032	942,326	106,778	33,000	.....
Colorado	55,042,937	66,989,142	23,126,179	54,613,808	66,709,380	23,005,536	420,129	279,752	120,643
New Mexico	4,292,243	3,133,760	989,317	4,120,622	3,070,644	989,317	171,621	63,116	.....
Arizona	11,960,384	9,258,049	1,672,589	11,853,487	9,258,049	1,672,589	107,397	.....	.....
Utah	58,353,630	11,555,496	5,148,596	57,576,025	11,095,475	4,813,440	777,605	460,021	335,156
Nevada	16,501,470	12,993,362	4,299,631	16,476,039	12,977,000	4,299,631	25,431	16,362	.....
PACIFIC:									
Washington	39,964,268	22,510,528	20,789,849	32,109,905	16,316,527	18,621,544	7,854,363	6,194,001	2,168,305
Oregon	25,821,797	23,796,747	14,403,278	24,944,587	23,230,309	14,281,632	877,210	566,438	121,646
California	381,569,645	344,389,232	111,780,551	371,753,554	342,534,781	110,871,577	9,816,091	1,854,451	908,974

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—VALUE OF PLANT AND EQUIPMENT: 1917, 1912, AND 1907—Continued.

Table 73—Continued.

DIVISION AND STATE.	ACTUAL INCREASE IN VALUE OF PLANT AND EQUIPMENT.								
	Total.			Commercial.			Municipal.		
	1907–1917	1912–1917	1907–1912	1907–1917	1912–1917	1907–1912	1907–1917	1912–1917	1907–1912
UNITED STATES	$1,963,478,519	$884,713,875	$1,078,764,644	$1,878,982,766	$834,403,819	$1,044,578,947	$84,495,753	$50,310,056	$34,185,697
GEOGRAPHIC DIVISIONS:									
New England	152,343,461	91,457,553	60,885,908	149,720,258	90,004,076	59,716,182	2,623,203	1,453,477	1,169,726
Middle Atlantic	382,046,760	189,798,382	192,248,378	379,369,288	187,729,066	191,640,222	2,677,472	2,069,316	608,156
East North Central	373,568,481	188,851,966	184,716,515	341,433,165	171,124,230	170,308,935	32,135,316	17,727,736	14,407,580
West North Central	232,880,431	148,952,249	83,928,182	218,350,771	139,271,849	79,078,922	14,529,660	9,680,400	4,849,260
South Atlantic	125,853,125	50,056,533	75,796,592	118,202,197	45,463,660	72,738,537	7,650,928	4,592,873	3,058,055
East South Central	110,180,720	62,601,105	47,579,615	107,827,227	61,687,729	46,139,498	2,353,493	913,376	1,440,117
West South Central	79,243,981	35,172,379	44,071,602	73,947,778	32,433,687	41,514,091	5,296,203	2,738,692	2,557,511
Mountain	206,979,528	61,164,505	145,815,023	205,098,789	59,963,093	145,135,696	1,880,739	1,201,412	679,327
Pacific	300,382,032	56,659,203	243,722,829	285,033,293	40,726,429	238,306,864	15,348,739	9,932,774	5,415,965
NEW ENGLAND:									
Maine	15,645,240	8,348,049	7,297,191	15,428,968	8,184,810	7,244,158	216,272	163,239	53,033
New Hampshire	11,869,150	2,503,226	9,365,924	11,765,264	2,479,035	9,286,229	103,886	24,191	79,695
Vermont	8,488,381	5,695,279	2,793,102	7,975,418	5,350,905	2,624,513	512,963	344,374	168,589
Massachusetts	85,656,617	57,228,605	28,428,012	84,275,563	56,403,198	27,872,365	1,381,054	825,407	555,647
Rhode Island	10,375,447	6,364,015	4,011,432	10,377,366	6,342,390	4,034,976	−1,919	21,625	−23,544
Connecticut	20,308,626	11,318,379	8,990,247	19,897,679	11,243,738	8,653,941	410,947	74,641	336,306
MIDDLE ATLANTIC:									
New York	165,406,058	67,610,943	97,795,115	164,408,469	66,911,790	97,496,679	997,589	699,153	298,436
New Jersey	32,983,313	29,144,377	3,838,936	32,298,087	28,589,939	3,708,148	685,226	554,438	130,788
Pennsylvania	183,657,389	93,043,062	90,614,327	182,662,732	92,227,337	90,435,395	994,657	815,725	178,932
EAST NORTH CENTRAL:									
Ohio	55,270,744	28,583,850	26,686,894	49,522,667	24,030,163	25,492,504	5,748,077	4,553,687	1,194,390
Indiana	36,782,502	14,532,960	22,249,542	33,403,414	13,083,246	20,320,168	3,379,088	1,449,714	1,929,374
Illinois	134,287,213	60,325,220	73,961,993	118,734,324	53,147,212	65,587,112	15,552,889	7,178,008	8,374,881
Michigan	95,400,352	59,636,582	35,763,770	90,046,776	56,417,401	33,629,375	5,353,576	3,219,181	2,134,395
Wisconsin	51,827,670	25,773,354	26,054,316	49,725,984	24,446,208	25,279,776	2,101,686	1,327,146	774,540
WEST NORTH CENTRAL:									
Minnesota	54,005,249	33,782,420	20,222,829	51,439,144	31,864,214	19,574,930	2,566,105	1,918,206	647,899
Iowa	73,707,068	61,567,216	12,139,852	71,205,593	59,604,423	11,601,170	2,501,475	1,962,793	538,682
Missouri	34,405,925	19,646,975	14,758,950	33,091,013	19,294,998	13,796,015	1,314,912	351,977	962,935
North Dakota	6,386,635	3,125,000	3,261,635	6,087,854	2,963,875	3,123,979	298,781	161,125	137,656
South Dakota	12,116,857	3,605,179	8,511,678	11,503,036	3,126,446	8,377,460	612,921	478,733	134,188
Nebraska	22,650,803	17,051,628	5,599,235	20,212,242	15,509,620	4,702,622	2,438,621	1,542,008	896,613
Kansas	29,607,834	10,173,831	19,434,003	24,810,980	6,908,273	17,902,716	4,796,845	3,265,558	1,531,287
SOUTH ATLANTIC:									
Delaware, Maryland, and District of Columbia	10,004,902	4,045,348	5,959,554	9,652,070	3,787,934	5,864,136	352,832	257,414	95,418
Virginia	23,900,472	14,763,364	9,137,108	22,603,144	14,424,083	8,179,061	1,297,328	339,281	958,047
West Virginia	14,557,292	3,850,054	10,707,238	14,507,039	3,808,459	10,698,580	50,253	41,595	8,658
North Carolina	33,321,358	23,472,918	9,848,440	31,746,128	22,448,689	9,297,439	1,575,230	1,024,229	551,001
South Carolina	21,822,698	−3,386,288	25,208,986	21,278,717	−3,707,318	25,046,035	543,981	381,030	162,951
Georgia	15,355,659	2,819,020	12,536,639	13,880,910	1,763,351	12,117,559	1,474,749	1,055,669	419,080
Florida	6,890,744	4,492,117	2,398,627	4,534,189	2,998,402	1,535,727	2,356,555	1,493,655	862,900
EAST SOUTH CENTRAL:									
Kentucky	22,358,242	13,005,307	9,352,935	21,938,251	12,744,154	9,194,097	419,991	261,153	158,838
Tennessee	55,837,662	21,834,579	34,003,083	55,022,508	21,742,265	33,280,243	815,154	92,314	722,840
Alabama	20,504,023	28,071,123	1,432,900	29,021,974	27,850,792	1,171,182	482,049	220,331	261,718
Mississippi	2,480,793	−309,904	2,790,697	1,844,494	−649,482	2,493,976	636,299	339,578	296,721
WEST SOUTH CENTRAL:									
Arkansas	8,565,071	5,675,850	2,889,221	8,030,267	5,293,856	2,736,411	534,804	381,994	152,810
Louisiana	5,562,376	2,901,228	2,661,148	4,666,581	2,110,736	2,555,845	895,795	790,492	105,303
Oklahoma	16,307,649	10,175,873	6,221,776	13,878,136	9,108,924	4,769,212	2,519,513	1,066,949	1,452,564
Texas	48,718,885	16,419,428	32,299,457	47,372,794	15,920,171	31,452,623	1,346,091	490,257	846,834
MOUNTAIN:									
Montana	67,656,850	21,024,136	46,632,714	67,391,872	20,853,300	46,538,572	264,978	170,836	94,142
Idaho	25,125,372	−4,105,734	29,231,106	24,671,773	−4,370,600	29,042,373	453,599	264,866	188,733
Wyoming	3,282,454	2,024,748	1,257,706	3,175,676	1,950,970	1,224,706	106,778	73,778	33,000
Colorado	31,916,758	−11,946,205	43,862,963	31,608,272	−12,095,582	43,703,854	308,486	149,377	159,109
New Mexico	3,302,926	1,158,483	2,144,443	3,131,305	1,049,978	2,081,327	171,621	108,505	63,116
Arizona	10,288,205	2,702,835	7,585,460	10,180,898	2,595,438	7,585,460	107,397	107,397	.....
Utah	53,205,034	46,798,134	6,406,900	52,762,585	46,480,550	6,282,035	442,449	317,584	124,865
Nevada	12,201,839	3,508,108	8,693,731	12,176,408	3,499,039	8,677,369	25,431	9,069	16,362
PACIFIC:									
Washington	19,174,419	17,453,740	1,720,679	13,488,361	15,793,378	−2,305,017	5,686,058	1,660,362	4,025,696
Oregon	11,418,519	2,025,050	9,393,469	10,662,965	1,714,278	8,948,677	755,564	310,772	444,792
California	269,789,094	37,180,413	232,608,681	260,881,977	29,218,773	231,663,204	8,907,117	7,961,640	945,477

[1] A minus sign (−) denotes decrease.

COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—VALUE OF PLANT AND EQUIPMENT: 1917, 1912, AND 1907—Continued.

Table 73—Continued.

DIVISION AND STATE.	PER CENT OF INCREASE.[1]									PER CENT OF TOTAL.						PER CENT DISTRIBUTION.								
	Total.			Commercial.			Municipal.			Commercial.			Municipal.			Total.			Commercial.			Municipal.		
	1907–1917	1912–1917	1907–1912	1907–1917	1912–1917	1907–1912	1907–1917	1912–1917	1907–1912	1917	1912	1907	1917	1912	1907	1917	1912	1907	1917	1912	1907	1917	1912	1907
UNITED STATES	179.0	40.7	98.3	178.3	39.8	99.1	197.1	65.3	79.7	95.8	96.5	96.1	4.2	3.5	3.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
GEOGRAPHIC DIVISIONS:																								
New England	164.9	59.6	65.8	164.5	60.8	67.7	60.3	26.3	26.9	97.2	96.4	95.3	2.8	3.6	4.7	8.0	7.1	8.4	8.1	7.1	8.4	5.5	7.2	10.2
Middle Atlantic	97.5	32.5	49.1	97.7	32.4	49.3	76.8	50.5	17.4	99.2	99.3	99.1	0.8	0.7	0.9	25.3	26.8	35.7	26.2	27.6	36.9	4.9	5.3	8.1
East North Central	183.2	48.6	90.6	182.8	47.9	91.2	188.3	56.3	84.4	91.5	91.9	91.6	8.5	8.1	8.4	18.9	17.9	18.6	18.0	17.0	17.7	38.6	40.8	39.8
West North Central	369.6	87.5	97.2	271.3	87.3	98.2	246.7	90.1	82.3	93.6	93.7	93.2	6.4	6.3	6.8	10.4	7.8	7.9	10.2	7.6	7.6	16.0	13.9	13.7
South Atlantic	215.1	37.3	129.5	217.1	35.7	133.6	187.7	64.4	75.0	93.6	94.7	93.0	6.4	5.3	7.0	6.0	6.2	5.3	5.9	6.1	5.2	9.2	9.3	9.5
East South Central	*402.3*	83.5	173.7	*437.8*	87.2	*187.3*	85.4	21.8	52.3	*96.3*	94.4	*89.9*	3.7	5.6	10.1	4.5	3.4	2.5	4.5	3.4	2.3	4.0	5.4	6.4
West South Central	247.8	46.2	137.8	242.6	45.0	136.2	352.1	67.4	170.0	93.9	94.7	95.3	6.1	5.3	4.7	3.6	3.5	2.9	3.6	3.4	2.9	5.3	5.3	3.5
Mountain	360.7	30.1	254.1	360.9	29.7	255.4	341.2	97.6	123.2	99.1	99.4	99.0	0.9	0.6	1.0	8.6	9.3	5.2	8.9	9.6	5.4	1.9	1.6	1.3
Pacific	204.4	14.5	165.8	198.2	12.2	165.8	479.8	115.3	169.3	95.9	97.8	97.8	4.1	2.2	2.2	14.6	18.0	13.4	14.6	18.2	13.6	14.6	11.2	7.5
NEW ENGLAND:																								
Maine	123.9	41.9	57.8	124.0	41.6	58.2	116.7	68.5	28.6	98.6	98.8	98.5	1.4	1.2	1.5	0.9	0.9	1.2	0.9	0.9	1.2	0.3	0.3	0.4
New Hampshire	136.5	13.8	107.7	136.5	13.8	107.7	135.2	15.4	103.7	99.1	99.1	99.1	0.9	0.9	0.9	0.7	0.8	0.8	0.7	0.9	0.8	0.1	0.2	0.2
Vermont	*117.3*	*56.8*	*38.6*	*119.9*	*57.7*	*39.4*	*88.2*	*45.9*	*29.0*	*93.0*	*92.5*	*92.0*	*7.0*	*7.5*	*8.0*	0.5	0.5	0.6	0.5	0.5	0.6	0.9	1.0	1.4
Massachusetts	197.9	79.8	65.7	208.0	82.5	68.8	50.1	24.9	20.2	96.8	95.4	93.6	3.2	4.6	6.4	4.2	3.3	3.9	4.2	3.3	3.9	3.3	4.3	6.4
Rhode Island	141.6	56.1	54.7	142.2	56.0	55.3	−6.0	258.2	−73.8	99.8	99.9	99.6	0.2	0.1	0.4	0.6	0.5	0.7	0.6	0.5	0.7	(2)	(2)	0.1
Connecticut	151.4	50.5	67.0	156.7	52.7	68.2	57.1	7.1	46.7	96.6	95.3	94.6	3.4	4.7	5.4	1.1	1.0	1.2	1.1	1.0	1.2	0.9	1.4	1.7
MIDDLE ATLANTIC:																								
New York	65.4	19.3	38.7	65.4	19.2	38.8	65.1	38.2	19.5	99.4	99.5	99.4	0.6	0.5	0.6	13.7	16.1	23.0	14.2	16.6	23.8	2.0	2.4	3.5
New Jersey	50.6	42.2	5.6	49.7	41.6	5.7	265.1	142.4	50.6	99.0	99.4	99.6	1.0	0.6	0.4	3.2	3.2	5.9	3.3	3.3	6.2	0.8	0.5	0.6
Pennsylvania	248.5	56.6	122.6	253.0	56.7	125.2	58.6	43.5	10.5	99.0	98.9	97.7	1.0	1.1	2.3	8.4	7.6	6.7	8.7	7.7	6.9	2.1	2.4	4.0
EAST NORTH CENTRAL:																								
Ohio	129.9	41.3	62.7	126.6	37.2	65.1	167.8	98.6	34.9	90.6	93.3	92.0	9.4	6.7	8.0	3.2	3.2	3.9	3.0	3.1	3.7	7.2	6.6	8.0
Indiana	143.2	30.3	86.6	142.6	29.9	86.7	150.0	34.7	85.6	91.0	91.3	91.2	9.0	8.7	8.8	2.0	2.2	2.3	1.9	2.1	2.2	4.4	5.4	5.2
Illinois	152.4	37.2	83.9	144.4	36.0	79.8	261.5	50.1	140.8	90.3	91.2	93.3	9.7	8.8	6.7	7.3	7.5	8.0	6.9	7.0	7.8	16.9	18.6	13.9
Michigan	257.8	82.0	96.6	275.7	85.1	103.0	123.2	49.7	49.1	92.7	91.1	88.3	7.3	8.9	11.7	4.3	3.3	3.4	4.2	3.2	3.1	7.6	8.4	10.1
Wisconsin	494.6	70.5	248.6	*554.0*	70.5	269.5	*191.6*	70.9	70.6	94.9	94.9	89.5	5.1	5.1	10.5	2.0	1.7	1.0	2.0	1.6	0.9	2.5	2.4	2.6
WEST NORTH CENTRAL:																								
Minnesota	223.7	76.2	83.8	231.8	76.3	88.2	131.9	74.0	33.3	94.2	94.2	91.9	5.8	5.8	8.1	2.5	2.0	2.2	2.5	2.0	2.1	3.5	3.4	4.5
Iowa	738.0	278.2	121.6	795.2	290.0	129.6	242.2	124.9	52.2	95.8	92.9	89.7	4.2	7.1	10.3	2.7	1.0	0.9	2.8	1.0	0.8	2.8	2.0	2.4
Missouri	101.6	40.4	43.6	102.6	41.6	42.4	100.3	15.5	73.4	96.2	95.3	96.1	3.8	4.7	3.9	2.2	2.2	3.1	2.2	2.2	3.1	2.1	2.9	3.0
North Dakota	394.2	64.0	201.3	412.7	64.4	211.8	200.6	57.0	94.9	94.5	94.2	91.0	5.5	5.8	9.0	0.3	0.2	0.1	0.3	0.2	0.1	0.3	0.4	0.3
South Dakota	431.8	31.8	303.3	441.2	28.5	321.3	308.5	243.8	67.5	94.6	97.1	92.9	5.4	2.9	7.1	0.5	0.5	0.3	0.5	0.5	0.2	0.6	0.4	0.5
Nebraska	*307.2*	*131.4*	76.0	294.5	*134.1*	68.5	479.1	109.7	176.2	90.2	89.2	93.1	*9.8*	*10.8*	6.9	1.0	0.6	0.7	0.9	0.6	0.7	2.3	1.8	1.2
Kansas	449.3	39.1	294.9	424.6	29.1	306.4	642.0	143.3	204.9	84.7	91.2	88.7	15.3	8.8	11.3	1.2	1.2	0.6	1.0	1.1	0.6	4.4	3.0	1.8
SOUTH ATLANTIC:																								
Delaware, Maryland, and District of Columbia	29.4	10.1	17.5	28.7	9.6	17.4	201.4	58.1	27.4	98.4	98.9	99.0	1.6	1.1	1.0	1.4	1.8	3.1	1.5	1.9	3.2	0.5	0.6	0.8
Virginia	1,335.0	135.1	510.4	1,089.0	151.6	611.2	287.0	24.1	212.0	93.2	87.1	74.8	6.8	12.9	25.2	0.8	0.5	0.2	0.8	0.5	0.1	1.4	1.8	1.1
West Virginia	*542.6*	28.8	*399.1*	*561.8*	28.7	*514.3*	49.8	38.0	7.6	99.1	99.2	96.3	0.9	0.8	3.7	0.6	0.6	0.2	0.6	0.6	0.3	0.1	0.1	0.2
North Carolina	1,486.4	194.1	439.3	2,227.0	209.4	652.2	193.0	74.9	67.5	93.3	88.7	63.6	6.7	11.3	36.4	1.2	0.6	0.2	1.1	0.5	0.1	1.9	1.8	1.9
South Carolina	247.9	−10.0	286.4	253.6	−11.3	298.5	131.9	66.2	39.5	96.9	98.3	95.3	3.1	1.7	4.7	1.0	1.6	0.8	1.0	1.6	0.8	0.8	0.8	1.0
Georgia	208.8	14.2	170.5	222.9	9.6	194.6	130.8	68.3	37.2	88.5	92.2	84.7	11.5	7.8	15.3	0.7	0.9	0.7	0.7	0.9	0.6	2.0	2.0	2.6
Florida	422.7	111.5	147.1	559.0	127.6	189.3	287.8	88.8	105.4	62.7	58.3	49.8	37.3	41.7	50.2	0.3	0.2	0.1	0.2	0.1	0.1	2.5	2.2	1.9
EAST SOUTH CENTRAL:																								
Kentucky	215.9	66.0	90.3	223.1	67.0	93.5	80.1	38.2	30.3	97.1	96.5	94.9	2.9	3.5	5.1	1.1	0.9	0.9	1.1	0.9	0.9	0.7	0.9	1.2
Tennessee	743.1	52.6	452.5	824.6	54.4	498.7	96.9	5.9	85.9	97.4	96.2	88.8	2.6	3.8	11.2	2.1	1.9	0.7	2.1	1.9	0.6	1.3	2.0	2.0
Alabama	404.5	321.7	19.6	426.5	349.2	17.2	98.4	29.3	53.4	97.4	91.4	93.3	2.6	8.6	6.7	1.2	0.4	0.7	1.2	0.4	0.7	0.8	1.0	1.1
Mississippi	111.1	−6.2	125.7	139.6	−17.0	188.7	70.7	28.4	33.0	67.3	76.1	59.5	32.7	23.9	40.5	0.1	0.2	0.2	0.1	0.2	0.1	1.2	1.5	2.1
WEST SOUTH CENTRAL:																								
Arkansas	445.5	118.0	150.3	533.4	124.8	181.7	128.2	67.0	36.6	90.9	88.2	78.3	9.1	11.8	21.7	0.3	0.2	0.2	0.3	0.2	0.1	0.7	0.7	1.0
Louisiana	47.9	20.3	22.9	41.9	15.4	22.9	187.9	135.8	22.1	92.0	95.9	95.9	8.0	4.1	4.1	0.6	0.7	1.1	0.6	0.6	1.1	1.1	0.9	1.1
Oklahoma	*230.0*	76.2	87.3	*200.3*	77.9	68.8	34.5	64.5	717.8	88.4	87.6	97.2	11.6	12.4	2.8	0.8	0.6	0.7	0.7	0.6	0.7	2.1	2.2	0.4
Texas	430.6	37.6	285.5	434.4	37.6	288.4	330.0	39.8	207.6	97.1	97.1	96.4	2.9	2.9	3.6	2.0	2.0	1.0	2.0	2.0	1.0	1.4	1.6	1.0
MOUNTAIN:																								
Montana	376.9	32.6	259.8	376.4	32.4	259.9	557.7	120.6	198.2	99.6	99.8	99.7	0.4	0.2	0.3	2.9	3.0	1.6	2.9	3.1	1.7	0.3	0.2	0.1
Idaho	772.7	−12.6	889.0	770.1	−13.6	906.6	947.1	111.9	394.1	98.2	99.3	98.5	1.8	0.7	1.5	0.9	1.5	0.3	1.0	1.5	0.3	0.4	0.3	0.1
Wyoming	348.3	92.0	133.5	337.0	90.0	136.0	.....	223.6	.....	97.5	98.5	100.0	2.5	1.5	.....	0.1	0.1	0.1	0.1	0.1	0.1	0.1	(2)	.....
Colorado	138.0	−17.8	189.7	137.4	−18.1	190.0	255.7	53.4	131.9	99.2	99.6	99.5	0.8	0.4	0.5	1.8	3.1	2.1	1.8	3.2	2.2	0.3	0.4	0.3
New Mexico	333.9	*37.0*	*216.8*	*316.5*	*34.2*	210.4	.....	171.9	.....	96.0	98.0	100.0	4.0	2.0	.....	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	.....
Arizona	615.1	20.2	453.5	608.7	28.0	453.5	.....	.....	.....	99.1	100.0	100.0	0.9	.....	.....	0.4	0.4	0.2	0.4	0.4	0.2	0.1	.....	.....
Utah	1,033.4	405.0	124.4	1,096.2	418.8	130.5	132.0	69.0	37.3	98.7	96.0	93.5	1.3	4.0	6.5	1.9	0.5	0.5	2.0	0.5	0.5	0.6	0.6	0.8
Nevada	283.8	27.0	202.2	283.2	27.0	201.8	.....	55.4	.....	99.8	99.9	100.0	0.2	0.1	.....	0.5	0.6	0.4	0.6	0.6	0.4	(2)	(2)	.....
PACIFIC:																								
Washington	92.2	77.5	8.3	72.4	96.8	−12.4	262.2	26.8	185.7	80.3	72.5	89.6	19.7	27.5	10.4	1.3	1.1	1.9	1.1	0.8	1.8	6.2	8.1	5.1
Oregon	79.3	8.5	65.2	74.7	7.4	62.7	621.1	54.9	365.6	96.6	97.6	99.2	3.4	2.4	0.8	0.8	1.1	1.3	0.8	1.1	1.3	0.7	0.7	0.3
California	241.4	10.8	208.1	235.3	8.5	208.9	979.9	429.3	104.0	97.4	99.5	99.2	2.6	0.5	0.8	12.5	15.8	10.2	12.7	16.3	10.5	7.7	2.4	2.1

[1] A minus sign (−) denotes decrease.

[2] Less than one-tenth of 1 per cent.

The absolute increases in the investment in commercial plants have been greatest in the older and more populous industrial states. Relatively, however, there has been, as is to be expected, a more rapid rate of growth during the last five years in the less developed portions of the country. Utah has led since 1912, with an increase of 418.8 per cent, followed by Alabama (349.2 per cent), Iowa (290 per cent), North Carolina (209.4 per cent), Virginia (151.6 per cent), Nebraska (134.1 per cent), Florida (127.6 per cent), and Arkansas (124.8 per cent). During the same period the investment in municipal plants has grown most rapidly in the state of California (429.3 per cent), though there are 11 other states in which the investment has more than doubled in the last five years.

In four states—South Carolina, Mississippi, Idaho, and Colorado—there has been a slight decrease in the amount of investment in commercial plants since 1912. This is in some cases due to the different method of handling the accounts at the later period, while in others it is occasioned by changes in ownership which have resulted in combining the balance sheets of electric companies with street railway systems. In some instances, also, there has been a change in ownership from commercial to municipal, which partially accounts for the decrease. All states report an increase in the investment of municipal plants since 1912.

The investment in municipal stations forms the highest per cent of the total in Florida (37.3 per cent), Mississippi (32.7 per cent), Washington (19.7 per cent), Kansas (15.3 per cent), Oklahoma (11.6 per cent), and Georgia (11.5 per cent). In no other states is the amount equal to 10 per cent of the total. It must be further noted that two divisions—the New England and the East South Central—show a decrease since 1912 in the relative amount of municipal plant investment, while 19 different states show a similar decrease. In 4 states the proportion remains as in 1912, while the remaining 25 show an increase which in some cases is very slight. There are 26 states which report a decrease in the relative importance of municipal plant investment since 1907.

On account of the wide differences which prevail, not only among plants under the same form of ownership but also under commercial and municipal ownership, it is doubtful whether statistics showing the average value per station have any great significance. Such figures, however, are highly interesting and probably indicate the general condition with a reasonable degree of accuracy. The average investment per commercial station in 1917 was $694,370 as compared with an average of $573,548 in 1912, $304,458 in 1907, and $172,093 in 1902. Municipal plants at the same dates report average investments of $54,950, $49,337, $34,249, and $27,019. It appears, therefore, that while the average investment in commercial stations has more than quadrupled since 1902, the investment in municipal stations has merely doubled since that date.

Table 74 AVERAGE VALUE OF COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS: 1917, 1912, 1907, AND 1902.

	All stations.	Generating stations.	Purchasing stations.
1917:			
Commercial	$694,370	$850,812	$97,321
Municipal	54,950	58,951	41,809
1912:			
Commercial	573,548	611,306	295,941
Municipal	49,337	47,367	69,997
1907:			
Commercial	304,458	(1)	(1)
Municipal	34,249	(1)	(1)
1902:			
Commercial	172,093	(1)	(1)
Municipal	27,019	(1)	(1)

[1] Figures not available.

For 1912 and 1917 it has been possible to separate the investment accounts of plants purchasing all of their current from those which generate current. On the basis of this separation it appears, as shown in Table 74, that the average investment in commercial generating stations in 1917 was markedly higher than that in the purchasing stations, $850,812 as opposed to $97,321. The difference between the two classes of stations was not great in the case of the municipally owned plants. In 1912, however, the average investment in commercial purchasing stations was almost half as great as in the generating stations. This condition is occasioned almost wholly by the fact that one or two very large plants in the state of New York were in 1912 purchasing all of their current, while in 1917 they were generating a portion of their output. It is also true that there has been under both classes of ownership a considerable growth in the number of small purchasing plants since 1912.

Table 75 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—VALUE OF PLANT AND EQUIPMENT; AVERAGE VALUE PER KILOWATT CAPACITY OF DYNAMOS AND PER HORSEPOWER OF PRIMARY POWER MACHINES: 1917, 1912, AND 1907.

	Total.			Commercial.			Municipal.		
	1917	1912	1907	1917	1912	1907	1917	1912	1907
Number of stations	6,542	5,221	4,714	4,224	3,659	3,462	2,318	1,562	1,252
Generating all or part of current	5,124	4,646	4,487	3,347	3,220	(1)	1,777	1,426	(1)
Purchasing all current	1,418	575	227	877	439	(1)	541	136	(1)
Value of plant and equipment	$3,060,302,141	$2,175,678,266	$1,006,913,622	$2,933,016,941	$2,098,613,122	$1,054,034,175	$127,375,200	$77,065,144	$42,879,447
Plants generating all or part of current	$2,952,423,577	$2,036,240,492	(1)	$2,847,666,813	$1,968,695,006	(1)	$104,756,764	$67,545,486	(1)
Plants purchasing all current	$107,968,564	$130,437,774	(1)	$85,350,128	$129,918,116	(1)	$22,618,436	$9,519,658	(1)
Kilowatt capacity of dynamos	8,994,407	5,165,439	2,709,225	8,411,944	4,768,762	2,500,209	582,463	396,677	209,016
Average value per kilowatt capacity of dynamos for all stations	$340	$421	$405	$349	$440	$422	$219	$194	$205
Average value for generating stations only	$328	$394	(1)	$339	$413	(1)	$180	$170	(1)
Horsepower of primary power machines	12,936,755	7,530,044	4,098,188	12,077,657	6,970,716	3,776,837	859,098	559,328	321,351
Average value per horsepower of primary power machines for all stations	$237	$289	$268	$243	$301	$279	$148	$138	$133
Average value for generating stations only	$228	$270	(1)	$230	$282	(1)	$122	$121	(1)

[1] Not reported.

In Table 75 is shown the number of commercial and municipal stations at the last three census periods, classified according to whether they generate current or purchase all current, together with the value of plant and equipment and the average value per kilowatt capacity of dynamos and per horsepower of prime movers. At the earlier census periods no attempt was made in computing this average invest-

ment to separate those plants not supplied with generating equipment from those which had such equipment. Accordingly, the per capacity investment figures were unduly high. The separation, however, has been made for 1912 and 1917, as indicated in the table. Owing to the small number and relative unimportance of purchasing stations in 1907, the combined figures for that date also are approximately correct. For the sake of comparison with earlier censuses the average value per kilowatt and per horsepower, based on the total value of all stations, is given along with the true value for generating plants only, computed for 1912 and 1917. The latter figures alone have any real significance.

The average value per kilowatt capacity for generating plants only has decreased since 1912 from $394 to $328 in 1917. If the generating equipment not in use at this period, reported by those plants which purchased all of their current and amounting to 50,984 kilowatts, were to be deducted from the total capacity of dynamos returned for all stations, the average figure for 1917 would be about $330 per kilowatt. Since, however, no separate statistics of this equipment not in use are at hand for commercial and municipal plants taken separately, it is scarcely worth while to mention this negligible difference. A similar decrease in average value per horsepower of prime movers is to be noted since 1912, from $270 to $228.

The general decrease in per capacity value indicated for recent years may be explained by some of the following considerations: First, the installation of larger units, which cost relative to their size less than the smaller units and which require less space for installation, etc., has led to economies in investment resulting in a lower average per kilowatt and per horsepower. Secondly, after generating plants have been properly constructed the installation of new generating units to meet the needs of developing business does not necessarily entail any appreciable increase in the investment in buildings or in much of the central station equipment. Hence a natural decrease in per capacity investment may be expected in case of normal growth. Again, on account of the high prices which prevailed during the past two or three years of the period, it is probable that every effort was made to reduce capital outlays to a minimum, even though, on account of the increased demand for electric service, it was necessary to install new generating equipment. Finally, it must be remembered that for this census, as previously stated, the schedules call for the *value* of plant and equipment instead of the *cost* of plant and equipment, as was the case at earlier periods. Accordingly, central stations are at liberty to return the depreciated value of their plants, and no doubt the investment figures secured are correspondingly lower than they were in 1912 and 1907. The increasing number of very large generating stations has also been significant in this connection because of the elimination of needless duplication in buildings, equipment, etc. Other considerations may be involved, but these would seem to be sufficient to account for the changes.

These general suggestions apply particularly to the commercial stations which have decreased their value per kilowatt capacity from $413 in 1912 to $339 in 1917. Municipal plants appear not to have conformed to the general rule, since they report an actual increase of investment per kilowatt from $170 in 1912 to $180 in 1917. This increase is too slight to be of much significance, but it may be suggested that plants under this form of ownership would not necessarily be influenced by the same motives which probably led to economies in investment during the last few years in commercial plants. Municipal stations do not have dividends to pay, and municipal bonds have been particularly in demand during the period of heavy income taxes, when it has been easy for such plants to increase their capital accounts. Further, many municipal plants appear to have been passing through a stage of development and expansion which was reached by commercial stations a good many years ago and which, accordingly, has necessitated a relatively heavier capital investment. Finally, the more rapid increase in the number of municipal generating stations, 24.6 per cent, since 1912, as opposed to 3.9 per cent for commercial stations during the same period, has occasioned duplication of buildings and equipment and other wastes in investment which are unavoidable when small generating stations are numerous.

Reasons for the lower actual per capacity investment in municipal stations at all periods have already been given. Not only are the figures in many cases questionable, but even when they are accurate it must be remembered that, owing to the restricted nature of their business and the limited territory which they serve, their capital outlays will naturally be much lower than those of commercial stations.

EXPENSES.

Classified expenses.—The method of reporting expenses of central electric light and power stations has been practically the same at the last two census periods, though, on account of the different requirements in 1902 and 1907, it is impossible to make detailed comparisons with the figures collected at the earlier dates. In order to secure as full a statement as possible, electric stations have been required to return not merely their ordinary expenses of operation and maintenance, together with taxes, but also those charges for interest, depreciation, and sinking fund requirements, which are, in accordance with the usual accounting practice, regarded as deductions from net income. There is, of course, some difference of opinion as to whether, in comparing the financial

results of operation of commercial and municipal plants, it is proper to include all of these charges under operating expenses. This is particularly true of the payments to the sinking fund made by publicly owned plants with a view to retiring their bonded indebtedness within a fixed period. Such a policy is not ordinarily followed by commercial stations. But in every case the two groups will be uniformly handled for comparative purposes, and it will be possible for the student of the problem to separate particular items from the general expenses in making any analyses which he may have in mind.

In Table 76 expenses are shown in detail for 1917 and 1912, together with the relative importance of the various items for all stations as well as for commercial and municipal plants taken separately and the per cent of increase during the period. It appears that the expenses have increased more rapidly during the last five years than the income, 81.8 per cent as opposed to 74.3 per cent. A number of items also have been subject to an unusually marked increase. The most important of these are the following: Fuel, 150.2 per cent; taxes, 128.6 per cent; and electric current purchased, 114.8 per cent. The rapid growth in expenditures for rentals of different sorts (133.2 per cent) is probably deserving of little comment. The relatively greatly increased charges for sinking funds and reserve funds (184.3 per cent) indicate a more cautious financial policy as regards the future of central stations.

Table 76 CENTRAL ELECTRIC STATIONS—EXPENSES, WITH PER CENT OF INCREASE AND PER CENT DISTRIBUTION: 1917 AND 1912.

ACCOUNT.	Amount.		Per cent of increase.	Per cent distribution.					
				All stations.		Commercial.		Municipal.	
	1917	1912		1917	1912	1917	1912	1917	1912
Total expenses	$426,568,307	$234,577,277	81.8	100.0	100.0	100.0	100.0	100.0	100.0
Fuel	87,272,088	34,877,297	150.2	20.5	14.9	19.8	14.0	28.6	25.8
Electric current and electric power purchased	38,818,430	18,074,344	114.8	9.1	7.7	9.0	7.8	9.8	6.9
Rent of offices, conduits, underground and water privileges	9,978,834	4,279,596	133.2	2.3	1.8	2.5	1.9	0.3	0.4
Supplies, materials, and other miscellaneous expenses, not elsewhere specified	53,119,932	30,714,823	73.0	12.5	13.1	12.2	12.7	16.0	18.6
Salaries and wages	95,241,858	61,161,941	55.7	22.3	26.1	21.9	25.6	27.9	32.5
Taxes (total)	30,062,962	13,147,338	128.6	7.1	5.5	7.6	6.0	0.5	0.2
Real and personal property	15,585,614	8,048,291	93.6	3.7	3.4				
Capital stock	1,307,378	997,012	31.1	0.3	0.4				
Federal corporation	4,603,232	558,706	723.9	1.1	0.2				
Earnings	5,133,526	2,598,338	97.6	1.2	1.1				
Miscellaneous	3,433,212	944,991	263.3	0.8	0.4				
Injuries and damages	1,697,391	1,200,989	41.3	0.4	0.5	0.4	0.5	0.2	0.3
Insurance	3,783,965	2,320,151	63.0	0.9	1.0	0.9	1.0	0.8	0.9
Interest on funded and floating debt	73,584,279	48,302,900	52.3	17.2	20.6	18.0	21.5	7.8	8.5
Charges for depreciation	28,307,104	18,843,863	50.2	6.6	8.0	6.7	8.3	6.4	5.1
Charges for sinking and reserve funds	4,702,364	1,654,035	184.3	1.1	0.7	1.0	0.7	1.7	0.8

Attention should be called to the per cent which the different items formed of the total outlays of the two groups of plants in 1917 and 1912. The most significant change in this respect for commercial plants is found in the cost of fuel, which in 1912 formed only 14 per cent of all expenses, while in 1917 it amounted to 19.8 per cent. These figures suggest a greatly increased price of fuel during the period. It is interesting to note, however, that municipal stations have not been subject to so great a change in this regard, as the increase has been only from 25.8 per cent in 1912 to 28.6 per cent in 1917. Possibly municipal stations in many cases profit by a relatively lower rate on coal, which is purchased in large quantities for general municipal uses. In both groups of stations the relative importance of salaries and wages in the annual outlays has decreased markedly, while there has also been a percentage decrease in expenditures for interest. The fact that at both periods the payments made by commercial plants for supplies, materials, etc., form a much lower percentage of the total than is found in municipal stations may indicate that the former sometimes follow the policy of charging to the capital account certain outlays for renewals, betterments, etc., which the latter are disposed to charge against income.

In order to show the increase in expenses for commercial and municipal stations since 1907 as well as the per cent which the items reported by each group form of the total for corresponding items reported by all stations, Table 77 has been prepared, with total expenses divided into only four groups.

The groups shown in Table 77 are no longer particularly illuminating because not sufficiently detailed. It does appear, however, that there has been little change during the past 10 years in the relative percentage of the total expenses reported by the commercial plants. Their outlays for fuel have increased from 86 per cent of the combined expenditure for this item in 1907 to 89.7 per cent in 1917. There has, on the other hand, been a drop in the proportion paid for purchased current from 94.8 per cent to 92.1 per cent. The outlays for supplies and materials, including salaries and wages, have continued at practically the same ratios. The proportionate outlays of municipal plants are relatively highest for fuel and lowest for rents and fixed charges, etc.

Table 77 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—EXPENSES: 1917, 1912, AND 1907.

CLASS.	Total.	Commercial.	Municipal.	Per cent of total. Commercial.	Per cent of total. Municipal.
Number of stations:					
1917	6,542	4,224	2,318	64.6	35.4
1912	5,221	3,659	1,562	70.1	29.9
1907	4,714	3,462	1,252	73.4	26.6
Total expenses:					
1917	$426,568,307	$395,127,395	$31,440,912	92.6	7.4
1912	234,577,277	217,660,112	16,917,165	92.8	7.2
1907	134,196,911	123,880,291	10,316,620	92.3	7.7
Rent of offices, conduits, and water privileges; taxes, interest on funded and floating debt, injuries and damages, insurance, and charges for depreciation and sinking fund:					
1917	152,115,999	146,516,827	5,599,172	96.3	3.7
1912	89,748,872	87,022,175	2,726,697	97.0	3.0
1907	51,061,122	49,434,241	1,626,881	96.8	3.2
Cost of fuel:					
1917	87,272,088	78,286,011	8,986,077	89.7	10.3
1912	34,877,297	30,501,988	4,375,309	87.5	12.5
1907	23,057,745	19,824,962	3,232,783	86.0	14.0
Cost of electric power purchased:					
1917	38,818,430	35,733,235	3,085,195	92.1	7.9
1912	18,074,344	16,912,612	1,161,732	93.6	6.4
1907	6,417,237	6,080,905	336,332	94.8	5.2
Supplies and materials, including salaries and wages, and other expenses not elsewhere included:					
1917	148,361,790	134,591,322	13,770,468	90.7	9.3
1912	91,876,764	83,223,337	8,653,427	90.6	9.4
1907	53,660,807	48,540,183	5,120,624	90.5	9.5
	PER CENT OF INCREASE.				
Number of stations:					
1907–1917	38.8	22.0	85.1	.....	.....
1912–1917	25.3	15.4	48.4	.....	.....
1907–1912	10.8	5.7	24.8	.....	.....
Total expenses:					
1907–1917	217.9	219.0	204.8	.....	.....
1912–1917	81.8	81.5	85.8	.....	.....
1907–1912	74.8	75.7	64.0	.....	.....
Rent of offices, conduits, and water privileges; taxes, interest on funded and floating debt, injuries and damages, insurance, and charges for depreciation and sinking fund:					
1907–1917	197.9	196.4	244.2	.....	.....
1912–1917	69.5	68.4	105.3	.....	.....
1907–1912	75.8	76.0	67.6	.....	.....
Cost of fuel:					
1907–1917	278.5	294.9	178.0	.....	.....
1912–1917	150.2	156.6	105.4	.....	.....
1907–1912	51.3	53.8	35.3	.....	.....
Cost of electric power purchased:					
1907–1917	504.9	487.6	817.3	.....	.....
1912–1917	114.8	111.3	165.6	.....	.....
1907–1912	181.7	178.1	245.4	.....	.....
Supplies and materials, including salaries and wages, and other expenses not elsewhere included:					
1907–1917	176.5	177.3	168.9	.....	.....
1912–1917	61.5	61.7	59.1	.....	.....
1907–1912	71.2	71.4	69.0	.....	.....

Fuel.—The outlays for fuel amount to about one-fifth of the total expenses of commercial plants and considerably more than one-fourth of the expenses of municipal plants. Hence, in view of the increasing importance of this item, some mention should be made of the quantity and kind of fuel used by the two groups of plants, as well as of the cost. From Table 78 it appears that bituminous coal is almost the only kind of fuel used in the New England states, as well as in the East South Central division. In the Middle Atlantic states, however, in addition to bituminous coal, a very large quantity of anthracite is used, about three-tenths of the total tonnage of coal consumed. In no other division is anthracite of any importance, and the East South Central division reports no anthracite whatever. The East North Central division reports the highest amount of bituminous coal as well as next to the largest quantity of gas, a large proportion of which is probably natural gas. In the West North Central, South Atlantic, and Mountain divisions it appears that practically every kind of fuel is used, but particularly bituminous coal, oil, and gas. The West South Central and Pacific divisions use oil and gas to the practical exclusion of other kinds of fuel. A very small amount of coke is used in all divisions except the West South Central and the Pacific. There are in addition a number of small plants, particularly in the South Atlantic and East South Central divisions, which use, wholly or in part, wood and refuse from sawmills, which are frequently obtainable in place of the commoner kind of fuel at extremely low cost.

The highest outlays for fuel are found, as might be expected, in the Middle Atlantic and East North Central divisions. Commercial plants expend the most for this item in the states of Pennsylvania ($11,862,075), New York ($10,442,556), and Illinois ($8,296,638). Municipal plants report the highest outlay for fuel in Ohio ($981,433), Michigan ($680,606), Indiana ($611,262), Minnesota ($538,722), Kansas ($533,201), and Massachusetts ($475,016).

Many plants report several different kinds of fuel, and as the census did not ask for the actual quantity of fuel used until 1917, some of the figures returned may be open to question. This is probably true of the reported consumption of oil, which was returned only by "barrels," but not reduced to a standard number of gallons per barrel. On account of the conditions which exist, it is obviously impossible to give the average cost of the different kinds of fuel either by states or divisions. It was found, however, as a result of special investigation, that prices for what appeared to be the same quality of fuel varied to an unusual degree, depending upon the nearness to sources of supply, the existing transportation facilities, the size of plants, and the terms of contracts which had been entered into with dealers in fuel. Some large stations, securing their supply of coal, for example, under five-year contract, may have paid no more per ton in 1917 than in 1912, while others not so fortunately situated felt the full burden of the increased prices. At any rate, it was found that the tonnage rate even for bituminous coal varied from $2 or $3 to $12, and even more. The average rate for the year, however, may be fairly said to have been from $3.50 to $4 for a representative station. The price of oil was subject to an even greater fluctuation than that of coal. Some small stations in North Dakota or Montana reported a price as high as $12

to $15 per barrel as a result of abnormal conditions, while others near the large oil fields in Texas, Oklahoma, and California did not pay more than 50 or 60 cents per barrel. Finally, the reported price of gas also varied between wide extremes. One or two municipalities located in the vicinity of natural-gas wells actually received their supply practically without charge, though the usual rates varied from a minimum of 10 to about 20 cents per 1,000 cubic feet. Much higher rates, however, are frequently found.

CENTRAL ELECTRIC STATIONS—FUEL CONSUMED: 1917.

Table 78

	Total cost of fuel.	COAL. Anthracite (tons of 2,240 lbs.).	COAL. Bituminous (tons of 2,000 lbs.).	Coke (tons of 2,000 lbs.).	Oil (barrels).	Gas (1,000 cu. ft.).
UNITED STATES	$87,272,088	2,180,183	19,385,090	63,137	6,158,219	14,199,204
GEOGRAPHIC DIVISIONS:						
New England	8,561,287	32,046	1,329,864	8,593	8,203	3,100
Middle Atlantic	27,869,061	2,129,558	5,192,831	12,259	15,074	730,422
East North Central	25,648,006	3,060	7,836,061	8,851	235,255	2,816,504
West North Central	10,450,544	9,393	2,315,879	19,244	984,376	1,374,694
South Atlantic	4,644,437	5,200	1,090,738	5,632	230,720	1,116,076
East South Central	2,059,792		722,407	2,499	14,748	42,733
West South Central	3,386,078	150	374,909		1,603,561	6,021,909
Mountain	1,545,131	661	511,138	6,059	253,666	196,102
Pacific	3,107,752	115	11,263		2,812,616	1,297,664
NEW ENGLAND	8,561,287	32,046	1,329,864	8,593	8,203	3,100
Maine	57,312	263	5,601		418	
Commercial	53,886	249	5,006		418	
Municipal	3,426	14	595			
New Hampshire	341,140	5,261	40,373		253	
Commercial	332,730	5,261	39,483		253	
Municipal	8,410		890			
Vermont	88,162	91	11,345			
Commercial	56,320	91	7,004			
Municipal	31,842		4,341			
Massachusetts	4,589,175	7,281	819,602	6,033	1,934	
Commercial	4,114,159	3,126	755,905	6,033	1,593	
Municipal	475,016	4,155	63,697		341	
Rhode Island	1,160,609	1,072	159,767	730	2,367	
Commercial	1,160,609	1,072	159,767	730	2,367	
Municipal						
Connecticut	2,324,889	18,078	293,116	1,830	3,231	3,100
Commercial	2,251,198	17,753	281,763	730		
Municipal	73,691	325	11,353	1,100	3,231	3,100
MIDDLE ATLANTIC	27,869,061	2,129,558	5,192,831	12,259	15,074	730,422
New York	10,724,411	164,474	2,099,625	10,986	6,148	50,812
Commercial	10,442,556	162,539	2,049,235	10,986	8,378	14,736
Municipal	281,855	1,935	50,390		770	36,076
New Jersey	5,081,144	849,807	95,443		4,440	10
Commercial	5,019,326	843,081	90,488		2,229	
Municipal	61,818	6,726	4,955		2,211	10
Pennsylvania	12,063,506	1,115,277	2,997,763	1,273	1,486	679,600
Commercial	11,862,075	1,093,506	2,959,478	1,273	1,435	607,488
Municipal	201,431	21,771	38,285		51	72,112
EAST NORTH CENTRAL	25,648,006	3,060	7,836,061	8,851	235,255	2,816,504
Ohio	7,077,282	128	1,603,980		12,416	2,793,792
Commercial	6,095,849	128	1,360,648		3,322	2,600,631
Municipal	981,433		243,332		9,094	193,161
Indiana	2,839,852	670	1,173,398	30	5,465	22,712
Commercial	2,228,590	180	951,934	30	4,763	21,232
Municipal	611,262	490	221,464		702	1,480
Illinois	8,739,918	200	3,298,203		18,651	
Commercial	8,296,638	200	3,150,983		13,133	
Municipal	443,280		147,220		5,518	
Michigan	5,252,214	1,172	1,244,220	2,964	6,302	
Commercial	4,571,608	210	1,097,531	2,964	3,579	
Municipal	680,606	962	146,689		2,723	
Wisconsin	1,738,740	890	516,260	5,857	192,421	
Commercial	1,469,277	550	463,557	5,857	189,871	
Municipal	269,463	340	52,703		2,550	
WEST NORTH CENTRAL	10,450,544	9,393	2,315,879	19,244	984,376	1,374,694
Minnesota	1,877,056	3,143	361,374	719	18,118	25,535
Commercial	1,338,334	1,336	261,080	719	12,106	25,535
Municipal	538,722	1,807	100,294		6,012	
Iowa	1,713,904	567	450,847	261	31,508	300
Commercial	1,287,790		353,025	93	17,021	300
Municipal	426,114	567	97,822	168	14,487	
Missouri	2,552,184		719,576	664	265,874	219
Commercial	2,150,361		602,577	104	240,878	219
Municipal	401,823		116,999	560	24,996	
North Dakota	526,888	1,329	143,943		11,790	
Commercial	464,833	1,329	133,438		9,412	
Municipal	62,055		10,505		2,378	
South Dakota	442,329	4,022	57,834		32,526	120,000
Commercial	318,643	1,585	47,936		26,223	120,000
Municipal	123,686	2,437	9,898		6,303	
Nebraska	1,315,620	332	279,428	78	96,505	7,500
Commercial	964,081		218,177	78	74,950	7,500
Municipal	351,545	332	61,251		21,549	
Kansas	2,022,557		302,877	17,522	528,055	1,221,140
Commercial	1,489,356		221,377	17,522	360,032	861,323
Municipal	533,201		81,500		168,023	359,817
SOUTH ATLANTIC	$4,644,437	5,200	1,090,738	5,632	230,720	1,116,076
Delaware, Maryland, and District of Columbia	1,335,320	2,082	359,549	956	1,882	51,834
Commercial	1,240,797	2,082	343,076		604	51,834
Municipal	94,523		16,473	956	1,278	
Virginia	319,326	104	89,901		1,853	
Commercial	252,294	104	77,121		1,510	
Municipal	67,032		12,840		343	
West Virginia	763,165	1,200	281,704		144	1,003,902
Commercial	740,938	1,200	274,582		144	1,056,076
Municipal	22,227		7,212			7,826
North and South Carolina	1,239,870		263,033	4,333	4,056	
Commercial	947,924		208,085	4,333	2,322	
Municipal	291,946		54,948		1,734	
Georgia	490,847	1,714	70,704		2,660	
Commercial	216,060	1,714	44,031		257	
Municipal	274,787		35,763		2,403	
Florida	495,909	100	16,607	343	220,125	340
Commercial	278,467		10,697	343	93,573	340
Municipal	217,442	100	5,910		126,552	
EAST SOUTH CENTRAL	2,059,792		722,407	2,499	14,748	42,733
Kentucky	989,161		282,671	2,258	9,779	42,733
Commercial	590,367		240,186	1,164	9,426	42,733
Municipal	92,794		42,485	1,094	353	
Tennessee	585,402		200,519	115	962	
Commercial	423,813		133,510	115	334	
Municipal	161,079		67,009		628	
Alabama	415,760		152,653	126	698	
Commercial	324,739		133,732	126	298	
Municipal	91,021		18,921		400	
Mississippi	369,379		86,564		3,309	
Commercial	218,081		47,050		2,252	
Municipal	151,298		39,514		1,057	
WEST SOUTH CENTRAL	3,386,078	150	374,909		1,603,561	6,021,909
Arkansas	395,784		79,457		10,275	920,777
Commercial	307,283		63,143		7,540	824,986
Municipal	88,501		16,314		2,735	95,791
Louisiana	298,856		25,002		61,166	384,573
Commercial	158,879		11,576		43,351	384,500
Municipal	139,977		13,426		17,815	73
Oklahoma	834,404		82,706		116,738	4,260,818
Commercial	566,316		38,986		90,124	3,829,515
Municipal	268,088		43,810		26,614	431,303
Texas	1,857,034	150	187,654		1,415,382	1,056,741
Commercial	1,741,923		144,987		1,389,853	1,055,741
Municipal	115,111	150	42,667		25,529	
MOUNTAIN	1,545,131	661	511,138	6,059	253,666	196,102
Montana	165,284	160	49,493	5,103	5,299	4,291
Commercial	116,480	160	33,083	5,103	3,728	4,291
Municipal	48,804		16,410		1,571	
Idaho	7,954		660		310	
Commercial	6,877		660		90	
Municipal	1,077				220	
Wyoming	217,346		80,745		60,502	191,811
Commercial	204,216		79,152		59,676	169,165
Municipal	13,130		1,593		826	22,646
Colorado	675,339		306,622		1,540	
Commercial	535,877		294,649		567	
Municipal	39,462		11,973		973	
New Mexico	228,533	492	58,946	16	6,707	
Commercial	212,364		57,007	16	5,292	
Municipal	16,169	492	1,939		1,415	
Arizona	289,342		2,615	915	168,122	
Commercial	284,879		2,615	915	167,992	
Municipal	4,463				130	
Utah	22,617		10,329			
Commercial	17,307		7,234			
Municipal	5,310		3,095			
Nevada	38,716		1,728	25	11,186	
Commercial	38,716		1,728	25	11,186	
Municipal						
PACIFIC	3,107,752	115	11,263		2,812,616	1,297,664
Washington	200,042	115	10,713		91,593	
Commercial	88,105	115	10,133		15,542	
Municipal	111,937		580		76,051	
Oregon	143,679		550		39,365	
Commercial	134,760		550		38,442	
Municipal	8,919				923	
California	2,764,031				2,681,658	1,297,664
Commercial	2,664,330				2,583,114	1,297,664
Municipal	99,701				98,544	

Cost of purchased current.—Though the price of current purchased does not form so large a proportion of the total outlays as do some other items, it is more readily reducible to standard units. Hence it has been thought worth while to compute the average rates paid in the different geographic divisions by both commercial and municipal stations. First, however, it may be interesting to present figures covering the entire purchase of electric current in the United States for both central stations and electric railways. In Table 79 these relations are shown.

Table 79 CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PURCHASED CURRENT, KILOWATT HOURS, AND AMOUNT PAID FOR PURCHASED CURRENT, BY GEOGRAPHIC DIVISIONS: 1917 AND 1912.

DIVISION.[1]	Census year.	Total.			Central electric stations.			Electric railways.		
		Purchased current, kilowatt hours.	Amount paid for purchased current.	Average cost per kilowatt hour (cents).	Purchased current, kilowatt hours.	Amount paid for purchased current.	Average cost per kilowatt hour (cents).	Purchased current, kilowatt hours.	Amount paid for purchased current.[2]	Average cost per kilowatt hour (cents).
United States	1917	10,553,094,004	$81,664,687	0.8	5,605,745,962	$38,818,480	0.7	4,947,348,042	$42,846,257	0.9
	1912	5,630,861,358	42,778,673	0.8	2,613,502,605	18,074,344	0.7	3,017,358,753	24,704,329	0.8
New England	1917	771,186,984	7,762,019	1.0	578,110,859	5,422,171	0.9	193,076,125	2,339,848	1.2
	1912	232,382,012	2,818,501	1.2	136,821,236	1,304,330	1.0	95,560,776	1,424,171	1.5
Middle Atlantic	1917	3,550,175,198	29,501,269	0.8	1,917,380,779	12,059,998	0.6	1,632,794,419	17,441,271	1.1
	1912	1,884,722,386	13,778,379	0.7	989,404,314	5,982,590	0.6	895,318,072	7,795,789	0.9
East North Central	1917	2,046,026,703	16,306,258	0.8	615,605,822	6,363,600	1.0	1,430,420,881	9,942,658	0.7
	1912	1,073,512,511	9,584,184	0.9	276,742,512	2,933,041	1.0	796,769,999	6,651,143	0.8
West North Central	1917	1,066,035,177	8,130,403	0.8	790,508,038	5,717,411	0.7	275,527,139	2,412,992	0.9
	1912	383,167,448	3,945,449	1.0	183,535,438	2,135,944	1.1	199,632,010	1,809,505	0.9
South Atlantic	1917	839,261,940	5,216,613	0.6	416,165,234	2,477,242	0.6	423,096,706	2,739,371	0.6
	1912	706,663,959	3,364,814	0.5	407,716,658	1,831,265	0.4	298,947,301	1,533,549	0.5
East South Central	1917	563,459,551	1,949,704	0.3	355,590,851	773,401	0.2	207,868,700	1,176,303	0.6
	1912	57,811,414	507,933	0.9	15,948,772	131,697	0.8	41,862,642	376,236	0.9
West South Central	1917	228,053,605	2,324,594	1.0	157,603,725	1,282,283	0.8	70,449,880	1,042,311	1.5
	1912	92,487,788	952,253	1.0	38,763,468	311,664	0.8	53,724,320	640,589	1.2
Mountain	1917	420,967,553	2,321,096	0.6	338,811,725	1,486,939	0.4	82,155,833	834,157	1.0
	1912	259,796,097	1,590,136	0.6	188,201,530	1,032,516	0.5	71,594,567	557,620	0.8
Pacific	1917	1,067,927,288	8,152,731	0.8	435,968,929	3,235,295	0.7	631,958,359	4,917,436	0.8
	1912	940,317,743	6,237,024	0.7	376,368,677	2,321,297	0.6	563,940,066	3,915,727	0.7

[1] See p. 18 for states composing the several geographic divisions.

[2] Includes a small amount paid for power other than electric in 1912.

Central stations purchased 53.1 per cent of all current in 1917 and only 46.4 per cent in 1912. At the same dates their outlay for purchased current comprised 47.5 per cent and 42.3 per cent of the aggregate amount paid for purchased current. At each date the average rate paid by central stations was only seven-tenths of 1 cent, while the average for electric railways was eight-tenths of 1 cent in 1912, increasing to nine-tenths of 1 cent in 1917. The lowest average rate reported for central stations in 1917 was two-tenths of 1 cent in the East South Central division, while the highest rate, 1 cent, is found in the East North Central division. For electric railways the lowest average rate, six-tenths of 1 cent, is in the East South Central and the South Atlantic divisions, while the highest rate, 1.5 cents, is reported for the West South Central division.

In Table 80 is shown the number of commercial and municipal central stations which purchased all their current, as well as the number of kilowatt hours purchased, the amount paid, and the average cost per kilowatt hour.

Table 80 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—NUMBER OF STATIONS PURCHASING ALL CURRENT AND AMOUNT AND COST OF PURCHASED CURRENT, BY GEOGRAPHIC DIVISIONS: 1917.

DIVISION.	Total.				Commercial.				Municipal.			
	Number of stations.	Kilowatt hours purchased.	Amount paid for purchased current.	Average cost per kilowatt hour (cents).	Number of stations.	Kilowatt hours purchased.	Amount paid for purchased current.	Average cost per kilowatt hour (cents).	Number of stations.	Kilowatt hours purchased.	Amount paid for purchased current.	Average cost per kilowatt hour (cents).
United States	1,418	1,236,670,848	$12,996,451	1.1	877	1,074,545,276	$10,479,167	1.0	541	162,125,572	$2,517,284	1.6
New England	141	144,754,181	1,790,565	1.2	107	135,425,710	1,567,674	1.2	34	9,328,471	222,891	2.4
Middle Atlantic	202	430,451,842	3,785,840	0.9	174	420,533,674	3,632,261	0.9	28	9,918,168	153,579	1.5
East North Central	324	267,389,624	3,144,484	1.2	199	197,237,840	2,301,206	1.2	125	70,151,784	843,278	1.2
West North Central	341	153,162,909	1,479,171	1.0	141	136,269,850	931,163	0.7	200	16,893,059	548,008	3.2
South Atlantic	170	69,527,318	876,800	1.3	79	39,885,454	494,162	1.2	91	29,641,864	382,638	1.3
East South Central	26	18,470,623	220,057	1.2	19	17,391,411	190,245	1.1	7	1,079,212	29,812	2.8
West South Central	44	43,941,915	495,866	1.1	33	40,357,001	418,168	1.0	11	3,584,914	77,698	2.2
Mountain	79	36,845,353	447,762	1.2	59	33,204,041	383,371	1.2	20	3,641,312	64,391	1.8
Pacific	91	72,127,083	755,906	1.0	66	54,240,295	560,917	1.0	25	17,886,788	194,989	1.1

The figures in Table 80, it must be remembered, cover only a small portion of all current purchased by central stations, 1,236,670,848 kilowatt hours out of a total of 5,605,745,962 kilowatt hours. Hence it is apparent that, as a rule, only the smaller stations are involved and the rates paid for current will be

correspondingly higher. It is interesting, however, to find that the average rate paid by commercial plants was only 1 cent, while the average for municipal plants was 1.6 cents. The West North Central division reported the lowest average rate, seven-tenths of 1 cent, paid by commercial plants, while the highest rate, 1.2 cents, is found in four divisions—New England, East North Central, South Atlantic, and Mountain. Municipal plants secure their purchased current at the lowest rates in the Pacific division (1.1 cents) and the East North Central (1.2 cents). The highest rates are paid in the West North Central division (3.2 cents), the East South Central (2.8 cents), and the New England (2.4 cents).

Taxes.—Some special attention also should be given to the subject of taxes, which have increased very rapidly in amount during the last five years. While they were paid at an average rate of six-tenths of 1 per cent on the cost of plant and equipment in 1912, the rate was 1 per cent in 1917. Municipal plants, of course, are, as a rule, not subject to taxation, though they did expend $165,856 in 1917 for this purpose. This is due to the fact that in some states municipal lighting plants may, if they are so disposed, pay taxes on their real and personal property, the same as any other corporation, as a result of which they receive in return the usual market rates for services rendered to the municipality. About 70 per cent of all the taxes paid by municipal plants were reported by the East North Central division, and in this division the one state of Ohio returned a total of $78,654.

Table 81

KIND.	CENTRAL ELECTRIC STATIONS—TAXES, PER CENT DISTRIBUTION.	
	1917	1912
Total	100.0	100.0
Real and personal property	51.8	61.2
Capital stock	4.3	7.6
Federal corporation	15.3	4.2
Earnings	17.1	19.8
Miscellaneous	11.4	7.2

In Table 81 is shown the percentage distribution of the different kinds of taxes paid by commercial plants in 1917 and 1912. It is interesting to find that the relative importance of real and personal property taxes has decreased from 61.2 per cent of the total in 1912 to only 51.8 per cent in 1917. Federal corporation taxes, however, have shown a marked increase, from 4.2 per cent to 15.3 per cent of the total, while miscellaneous taxes have also increased rapidly in importance. The figures returned, however, are frequently open to question because of the fact that some stations misunderstood the requirements regarding the entry of these different items. No doubt some have reported taxes on earnings, under Federal corporation taxes, in the mistaken notion that the latter referred only to state as opposed to national taxes. In other cases, also, as a result of the wide diversity of new taxes recently imposed, it may be that many payments were incorrectly entered under "miscellaneous" which should have been otherwise reported.

Attention should also be called to the fact that the taxation policy followed by different states with respect to public service corporations varies widely. In Pennsylvania, for instance, there is little taxation of physical property, but comparatively high taxes are imposed on capital stock. In California, on the other hand, both real estate and capital stock taxes for this class of corporations are light, while a heavy tax is imposed on earnings. Other differences might be suggested, but it is sufficiently obvious that no detailed conclusions should be drawn from the aggregate figures as here reported. Suffice it to say that, whatever may be the basis on which taxes are levied, all central electric light and power stations were paying far heavier taxes in 1917 than in 1912, as shown by the fact that at the earlier period such outlays amounted to only 5.5 per cent of the total expenses, while in 1917 taxes formed 7.1 per cent of the total. The further fact, above mentioned, that the rate on the investment in plant and equipment has increased by exactly two-thirds is of even greater significance.

Interest, depreciation, and sinking-fund charges.—Perhaps those expenses which are frequently classified as fixed charges should be briefly considered in this connection. We find that in 1917 commercial stations charged $26,292,284 to depreciation, paid interest on funded and floating debt amounting to $71,144,843, and set aside for sinking and other reserve funds $4,156,942, making a total of $101,594,069, which is 25.7 per cent of all expenses reported for the year. Municipal plants during the same period expended $2,014,820 for depreciation, $2,439,436 for interest, and $545,422 for the sinking fund, making a total of $4,999,678, or 15.9 per cent of all expenses.

Upon comparing the relative importance of these outlays at the last two census periods, it appears that in 1912 commercial plants charged to depreciation an amount equal to nine-tenths of 1 per cent of their total investment. They also reported the same rate in 1917, though the proportion which this charge bears to the total expenses dropped from 8.3 per cent to only 6.7 per cent. Municipal plants, on the other hand, apparently expended 1.1 per cent of the total investment for this purpose in 1912 and 1.6 per cent in 1917, while the per cent which this item forms of the total expenses increased from 5.1 to 6.4 per cent.

Sinking and other reserve fund charges were in both cases of very slight importance. They were incurred by commercial plants in 1912 at a rate of two-tenths of 1 per cent on the funded indebtedness and at a rate of three-tenths of 1 per cent in 1917. For municipal plants, on the other hand, the rate was four-tenths of 1 per cent in 1912 and 1 per cent in 1917.

Table 82 CENTRAL ELECTRIC STATIONS—COMPARATIVE DEBT AND AVERAGE INTEREST RATES: 1917 AND 1912.

	Debt.	Interest paid.	Average rate of interest.
Commercial:			
1917	$1,515,586,568	$71,144,843	4.7
1912	1,045,804,964	46,864,763	4.5
Municipal:			
1917	58,638,089	2,439,436	4.2
1912	36,493,347	1,438,137	3.9

An interesting comparison can be made between the average rates of interest paid by municipal and commercial stations in 1912 and 1917. At the earlier period commercial stations, with a total indebtedness, including bonds, floating debt, and real estate mortgages, amounting to $1,045,804,964, paid an average rate of 4.5 per cent interest. At the same period municipal plants, with an outstanding debt of $36,493,347, paid at the rate of 3.9 per cent. By 1917 the average rate paid by commercial stations had increased to 4.7 per cent on an indebtedness of $1,515,586,568. Municipal plants, also, report an average rate of 4.2 per cent on a debt of $58,638,089.

INCOME.

Classified income.—Owing to the increased size of stations and the better utilization of existing equipment as a result of a more satisfactory load factor and diversity factor, the income of all electric stations, both commercial and municipal, has at all periods increased much more rapidly than the number of stations. This is particularly true for commercial stations, which since 1907 have shown a 22 per cent growth in number and an increase of 201.1 per cent in gross income. Municipal stations, on the other hand, have, during the same period, experienced an increase of 85.1 per cent in numbers and of 187.3 per cent in gross income. In other words, the rate of increase in the revenues of commercial plants has been more than nine times as rapid as the growth in number of stations, while for municipal plants it has been little more than twice as rapid.

The figures in Table 83 further show that the rate of increase in income of commercial stations has been relatively less rapid during the last five-year period, 74.4 per cent as compared with a 15.4 per cent growth in number of stations. During the same period, also, municipal plants increased in number by 48.4 per cent, while the income of this group increased 73.4 per cent. As compared with commercial plants, however, the rate of increase in the income from electric service of the municipal plants has been practically equal at all periods. The revenues derived from "all other sources," which include interest and dividends from investments, as well as net profits on sales and on wiring, repairs, etc., form a relatively small proportion of the total, especially in the case of municipal plants. The rate of increase in such revenues, while more rapid during the period 1907–1912 than the rate of increase in revenues from electric service only—151.1 per cent as opposed to 69.3 per cent for all stations—has been subject to a noticeable retardation during the latest five-year period, when the figures show a 64.1 per cent increase as opposed to an increased revenue from electric service of 74.8 per cent.

Table 83 CLASSIFICATION OF INCOME AND CENSUS YEAR. COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—GROSS INCOME.

	Total.	Commercial.	Municipal.
Number of stations:			
1917	6,542	4,224	2,318
1912	5,221	3,659	1,562
1907	4,714	3,462	1,252
Gross income:			
1917	$526,894,240	$486,634,021	$40,260,219
1912	302,273,398	279,054,409	23,218,989
1907	175,642,338	161,630,339	14,011,999
Electric service—			
1917	502,059,980	462,473,917	39,586,063
1912	287,138,657	264,474,949	22,663,708
1907	169,614,691	156,000,257	13,614,434
All other sources—			
1917	24,834,260	24,160,104	674,156
1912	15,134,741	14,579,460	555,281
1907	6,027,647	5,630,082	397,565
	PER CENT OF INCREASE.		
Number of stations:			
1907–1917	38.8	22.0	85.1
1912–1917	25.3	15.4	48.4
1907–1912	10.8	5.7	24.8
Gross income:			
1907–1917	200.0	201.1	187.3
1912–1917	74.3	74.4	73.4
1907–1912	72.1	72.6	65.7
Electric service—			
1907–1917	196.0	196.4	190.8
1912–1917	74.8	74.9	74.7
1907–1912	69.3	69.5	66.5
All other sources—			
1907–1917	312.0	329.1	69.6
1912–1917	64.1	65.7	21.4
1907–1912	151.1	159.0	39.7

Table 84 CENTRAL ELECTRIC STATIONS—INCOME.

ACCOUNT.	Amount.		Per cent of increase.	Per cent of total.	
	1917	1912		1917	1912
Total income	$526,894,240	$302,273,398	74.3	100.0	100.0
Electric service	502,059,980	287,138,657	74.8	95.3	95.0
Commercial light, power, and heat	402,262,985	221,200,466	81.8	76.3	73.2
Municipal street lighting	36,651,540	27,273,226	34.4	7.0	9.0
Municipal building lighting	(1)	2,504,511	.....	(1)	0.8
Current sold to other public service corporations	57,524,792	31,177,459	84.5	10.9	10.3
Estimated value of free service—					
Commercial stations	524,820	513,644	2.2	0.1	0.2
Municipal stations	5,095,843	4,469,351	14.0	1.0	1.5
Interest and dividends from investments	8,875,597	4,891,449	81.4	1.7	1.6
All other sources	15,958,663	10,243,292	55.8	3.0	3.4

[1] Not reported separately in 1917.

It is of some interest to note the rate of increase since 1912 in the revenues derived from the different kinds of service, together with the relative importance of the classified revenues at the two periods. The data presented in Table 84 show that there has been a slight falling off in the proportionate amount of income from "all other sources," from 3.4 per cent in 1912 to only 3 per cent in 1917. The income from commercial light, power, and heat has increased somewhat in relative importance, from 73.2 per cent of the total in 1912 to 76.3 per cent in 1917. There

has been little change relatively in the revenues received from the sale of current to other public service corporations, but municipal street lighting has experienced a decrease from 9 per cent at the earlier period to only 7 per cent in 1917. The less rapid rate of increase in revenues derived from street lighting will continue from year to year, as most municipalities in which electric service is available have already installed street-lighting systems to the needed extent. The estimated value of free service has in the case of commercial stations remained almost stationary, while the increase has been very slight, only 14 per cent, for municipal stations. These figures indicate that municipal plants are generally adopting the policy of charging for the services which formerly they rendered gratis to the municipalities in which they are located.

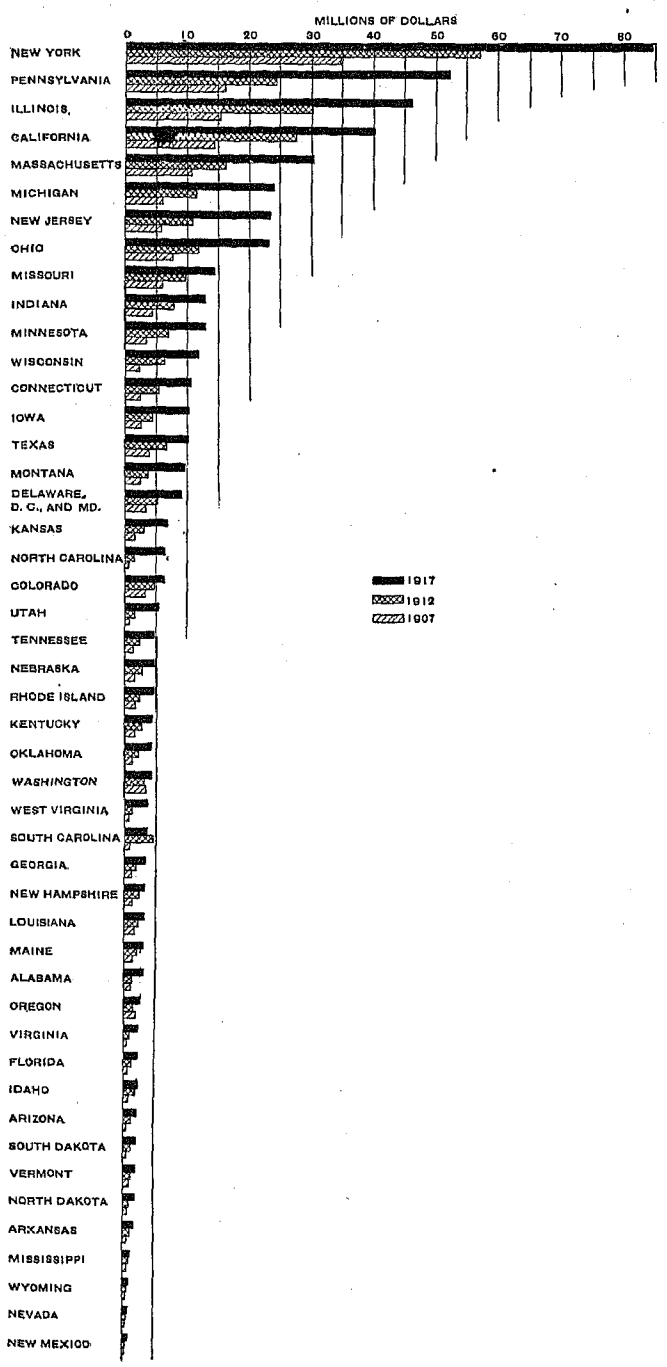
At the preceding census no attempt was made to secure a separate statement of the revenues derived from the sale of current for light and for power. The schedules for 1917, however, call for such a segregation whenever practicable. Further, the income derived from the sale of current for lighting public buildings was at this date combined with the general revenues from commercial lighting. In a number of cases, owing to the way in which accounts are kept, it was impossible to separate light and power revenues. In such instances, however, it nearly always happens that the current so used was metered separately, and, accordingly, it was possible to secure reasonably accurate estimates of the income from the two sources, so that the figures can be regarded as approximately correct. In Table 85 is shown the amount as well as the percentage distribution of income from the sale of current, together with the estimated value of free service, which is in almost every instance lighting service.

Table 85 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—INCOME: 1917.

CHARACTER OF SERVICE.	Total.	Commercial.	Municipal.	Per cent distribution.	
				Commercial.	Municipal.
Total	$502,059,980	$462,473,917	$39,586,063	100.0	100.0
Commercial lighting	241,062,303	218,448,126	22,614,177	47.2	57.1
Street lighting	36,651,540	31,461,959	5,189,581	6.8	13.1
Power	161,200,682	154,831,546	6,369,136	33.5	16.1
Other public service corporations	57,524,792	57,207,466	317,326	12.4	0.8
Estimated value of free service	5,620,663	524,820	5,095,843	0.1	12.9

It appears from Table 85 that the income from paid street lighting is relatively twice as important in the municipal station income as in that of commercial stations (13.1 per cent as oppposed to 6.8 per cent). In this connection, however, it should be noted that while the estimated value of free service is only one-tenth of 1 per cent of the total income in the case of the latter, it amounts to 12.9 per cent in the case of the former. Therefore, since practically all of this

DIAGRAM 15.—GROSS INCOME, BY STATES: 1917, 1912, AND 1907.



free service is for street lighting, the two items should be considered together, and the resultant figure is 26 per cent of the total income of municipal plants that is derived from street lighting. This amount, added to the commercial lighting income, 57.1 per cent, makes the entire income secured from different kinds of electric light 83.1 per cent of the total municipal plant revenues from the sale of current. The corresponding percentage for commercial stations is only 54.2 per cent. Other things being equal, municipal plants might be expected to charge somewhat lower rates per kilowatt hour for lighting service than commercial plants, in view of the fact that so large a proportion of their business is street light-

ing, which is normally furnished at a much lower unit cost than commercial and domestic lighting, partly because of the long hours of service. Commercial stations receive 33.5 per cent of their electric service income from the sale of current for power, a proportion more than twice as great as that of municipal plants. They report 12.4 per cent from the sale of current to other public service corporations as opposed to only eight-tenths of 1 per cent for municipal stations.

In view of the attention which has already been called to those states which lead in electric development, little need be said regarding the income statistics, classified according to states and geographic divisions. The gross income of commercial plants, however, is by far the highest in the Middle Atlantic division ($157,994,253) and the East North Central ($105,518,688). The New England division ranks next, with a gross income of only $51,377,071. The leading states are New York ($83,675,233), Pennsylvania ($51,160,607), Illinois ($42,417,210), California ($38,711,868), Massachusetts ($28,334,813), New Jersey ($23,158,413), Michigan ($21,787,591), and Ohio ($19,875,339). No other states approach these in the amount of income reported. For municipal stations the highest revenues are reported by the East North Central ($10,989,300) and the West North Central divisions ($7,658,024). The nearest rivals report little more than half the smaller amount. To the figures for these two divisions should also be added an estimated value of free service amounting, respectively, to $1,642,317 and $945,120. The states returning the highest revenues from municipal stations are Illinois, Ohio, Indiana, Michigan, Washington, Massachusetts, and Kansas, all of which, including free service, report an income in excess of $2,000,000. It is further noticeable that in many states in which municipal lighting plants are of importance little free service is rendered by them. This applies particularly to California, Wisconsin, and Washington.

Income of stations, classified according to dynamo capacity.—As at previous censuses, data have been assembled to show the income of stations grouped according to their dynamo capacity as well as of stations having no generating equipment. Accordingly, in Table 86 the relative importance of the different groups is clearly shown. It appears that during the the last 10 years there has been little increase in the income from electric service reported by stations having a dynamo capacity of less than 200 kilowatts. The rate of increase for this service during the decade in the next four groups, ranging from a capacity of 200 kilowatts to less than 5,000 kilowatts, has in no case been marked, the lowest being 47.1 per cent and the highest only 71.5 per cent. In the two lower groups, also, there has been an actual decrease for the period in revenues derived from "all other sources."

Table 86 CENTRAL ELECTRIC STATIONS—GROSS INCOME FOR STATIONS GROUPED ACCORDING TO DYNAMO CAPACITY: 1917, 1912, AND 1907.

CLASS OF INCOME AND CENSUS YEAR.	Total.	Stations grouped according to dynamo capacity.						Stations having no generating equipment.
		Under 200 kilowatts.	200 and under 500 kilowatts.	500 and under 1,000 kilowatts.	1,000 and under 2,000 kilowatts.	2,000 and under 5,000 kilowatts.	5,000 kilowatts and over.	
Number of stations:								
1917	6,542	3,348	899	335	242	182	237	1,299
1912	5,221	2,902	948	337	214	152	161	507
1907	4,714	3,038	821	269	160	115	75	227
Per cent of increase: 1907–1917	38.8	10.2	9.5	24.5	43.2	58.3	.....	472.2
Gross income:								
1917	$526,894,240	$18,197,458	$21,269,811	$18,019,711	$22,316,555	$34,374,216	$386,849,516	$25,866,973
1912	302,273,398	16,625,878	18,111,238	14,079,923	16,518,054	25,448,529	188,592,142	22,897,634
1907	175,642,338	17,140,070	14,786,719	10,465,110	13,149,808	21,915,199	89,930,073	8,255,359
Per cent of increase: 1907–1917	200.0	6.2	43.8	72.2	69.7	56.9	330.2	213.3
Electric service—								
1917	$502,059,980	$17,699,918	$20,531,425	$17,283,248	$21,511,270	$32,769,636	$367,104,799	$25,159,684
1912	287,138,657	15,934,092	17,166,227	13,322,200	15,832,795	24,398,710	179,265,042	21,219,591
1907	169,614,691	16,344,745	13,954,088	10,075,476	12,617,855	21,277,402	87,277,832	8,067,293
Per cent of increase: 1907–1917	196.0	8.3	47.1	71.5	70.5	54.0	320.6	211.9
All other sources:								
1917	$24,834,260	$497,540	$738,386	$736,463	$805,285	$1,604,580	$19,744,717	$707,289
1912	15,134,741	691,786	945,011	757,723	685,259	1,049,819	9,327,100	1,678,043
1907	6,027,647	795,325	832,631	389,634	531,953	637,797	2,652,241	188,066
Per cent of increase: 1907–1917	312.0	—37.4	—11.3	89.0	51.4	151.6	644.5	276.1

[1] A minus sign (—) denotes decrease. Percentages are omitted when base is less than 100.

The group of stations having a dynamo capacity in excess of 5,000 kilowatts reported an extraordinarily high percentage increase for the decade in gross income, 330.2 per cent, and the rate of increase for each five-year period was more than 100 per cent. In 1917 these stations, which comprised only 4.5 per cent of all stations supplied with generating equipment, reported 77.2 per cent of the entire income received by such stations. It is further significant that since 1907 there has been a very rapid growth, 213.3 per cent, in the gross income of stations having no generating equipment, though there has not been much change since 1912, due to the aforementioned fact that three large plants, at the earlier date purchasing all their current, now have some generating equipment. Finally, it is significant that, while the number of smaller generating stations has shown little change during the decade and while in two instances there has been an actual decrease during the past five years, the number in the highest group has increased 216 per cent and the number of stations without generating equipment has increased 472.2 per cent.

Average rates per kilowatt hour.—It may be of some interest to discuss briefly the average rates per kilowatt hour charged for the various services. Accordingly, Table 87 has been prepared to show, by geographic divisions and states, the general conditions which exist. Though in some cases the figures are open to question, owing to the fact that the output and disposal of current are frequently estimated and not measured by the smaller stations, yet it is thought that the figures are sufficiently dependable to be here presented.

Table 87 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—AVERAGE RATE PER KILOWATT HOUR: 1917 (CENTS).

DIVISION AND STATE.	Total.			Commercial.			Municipal.		
	Light.	Power.	Sold to other companies.	Light.	Power.	Sold to other companies.	Light.	Power.	Sold to other companies.
UNITED STATES	5.5	1.2	0.7	5.6	1.2	0.7	4.9	1.8	1.5
GEOGRAPHIC DIVISIONS:									
New England	6.9	1.7	0.9	6.9	1.7	0.9	6.8	2.1	2.0
Middle Atlantic	5.6	0.9	0.8	5.6	1.0	0.8	5.8	2.6	2.7
East North Central	4.9	1.6	0.7	5.2	1.6	0.7	3.7	1.7	1.6
West North Central	5.9	1.4	0.6	5.6	1.4	0.6	7.6	2.3	4.0
South Atlantic	5.4	1.0	1.0	5.0	0.9	0.7	6.7	2.0	0.5
East South Central	5.5	1.4	0.3	5.2	1.3	0.3	6.7	2.1	1.0
West South Central	6.4	2.1	1.1	6.2	2.1	1.0	7.8	2.6	1.9
Mountain	6.5	0.8	0.5	6.6	0.8	0.5	5.5	2.0	2.0
Pacific	4.5	1.2	0.7	5.0	1.2	0.7	2.7	1.1	0.4
NEW ENGLAND	6.9	1.7	0.9	6.9	1.7	0.9	6.8	2.1	2.0
Maine	6.5	0.8	0.9	6.7	0.8	0.9	5.1	3.5	.....
New Hampshire	8.0	1.9	0.8	7.9	1.8	0.8	10.5	6.5	.....
Vermont	7.4	1.7	1.0	8.3	1.7	1.0	5.1	1.5	1.7
Massachusetts	7.2	1.8	0.9	7.2	1.8	0.9	7.1	2.0	2.3
Rhode Island	5.8	1.4	1.0	5.8	1.4	1.0	13.1	.....	.....
Connecticut	6.3	2.2	1.1	6.3	2.2	1.1	6.8	2.8	.....
MIDDLE ATLANTIC	5.6	0.9	0.8	5.6	1.0	0.8	5.8	2.6	2.7
New York	5.3	0.7	0.7	5.3	0.7	0.7	5.8	2.3	4.0
New Jersey	8.5	2.1	0.9	8.5	2.1	0.9	7.6	3.0	.....
Pennsylvania	5.3	1.1	1.0	5.3	1.0	1.0	5.5	3.1	2.7
EAST NORTH CENTRAL	4.9	1.6	0.7	5.2	1.6	0.7	3.7	1.7	1.6
Ohio	3.8	1.6	0.7	3.8	1.6	0.7	3.8	1.6	1.6
Indiana	6.4	1.8	1.2	6.8	1.8	1.2	5.5	2.2	1.7
Illinois	4.6	2.0	0.7	5.2	2.0	0.7	2.4	1.4	4.0
Michigan	5.7	1.3	0.8	6.0	1.3	0.8	4.3	1.8	1.7
Wisconsin	5.9	1.6	0.6	5.6	1.5	0.6	4.4	3.1	1.4
WEST NORTH CENTRAL	5.9	1.4	0.6	5.6	1.4	0.6	7.6	2.3	4.0
Minnesota	4.6	1.1	0.5	4.2	1.1	0.5	7.3	4.1	4.3
Iowa	7.6	1.3	0.5	7.4	1.2	0.5	8.7	3.4	4.7
Missouri	5.3	1.7	0.7	5.0	1.7	0.7	8.3	1.8	2.2
North Dakota	10.0	4.4	2.3	10.0	4.3	2.3	9.7	5.4	.....
South Dakota	10.3	3.0	1.6	9.9	3.0	1.4	12.0	3.2	6.7
Nebraska	6.8	2.1	1.8	6.5	2.1	1.7	7.7	2.1	6.4
Kansas	6.2	1.5	1.4	6.2	1.5	1.3	6.1	1.6	5.0
SOUTH ATLANTIC	5.4	1.0	0.7	5.0	0.9	0.7	6.7	2.0	5.9
Delaware, District of Columbia, and Maryland	5.1	1.0	0.5	5.1	1.0	0.5	5.8	1.6	8.7
Virginia	5.5	1.4	0.8	6.1	1.3	0.8	4.4	2.2	.....
West Virginia	3.1	1.3	0.9	3.0	1.3	0.9	6.9	3.4	.....
North Carolina and South Carolina	6.1	0.8	0.7	5.9	0.8	0.7	6.4	1.6	5.0
Georgia	7.4	1.8	0.9	5.4	1.0	0.9	8.2	2.0	5.6
Florida	7.9	2.5	1.7	8.6	2.4	1.7	7.1	2.7	.....
EAST SOUTH CENTRAL	5.5	1.4	0.4	5.2	1.3	0.3	6.7	2.1	1.0
Kentucky	5.9	2.0	0.9	6.0	2.0	0.9	5.0	1.6	1.0
Tennessee	4.6	2.4	0.3	4.4	2.4	0.3	5.4	2.7	.....
Alabama	4.5	0.8	0.6	3.7	0.7	0.6	9.5	3.2	.....
Mississippi	8.0	2.1	1.3	7.8	2.3	1.3	8.3	1.7	.....
WEST SOUTH CENTRAL	6.4	2.1	1.1	6.4	2.1	1.1	7.8	2.6	1.9
Arkansas	7.2	2.8	1.2	7.1	2.7	1.2	7.6	3.6	.....
Louisiana	4.8	2.3	1.1	4.4	2.1	1.0	7.6	4.8	2.1
Oklahoma	7.6	1.8	1.3	7.0	1.8	1.2	9.8	1.7	4.5
Texas	6.6	2.2	1.0	6.7	2.2	1.0	6.1	2.4	0.8
MOUNTAIN	6.5	0.8	0.5	6.6	0.8	0.5	5.5	2.0	2.0
Montana	7.4	0.6	0.3	7.3	0.6	0.3	9.1	2.9	.....
Idaho	6.2	0.8	1.0	6.5	0.8	1.0	4.0	1.0	.....
Wyoming	6.3	2.1	2.1	6.1	2.0	2.1	10.4	30.9	.....
Colorado	5.8	1.6	0.6	5.8	1.6	0.6	7.2	3.5	3.6
New Mexico	10.8	3.2	2.3	10.7	3.4	2.3	11.7	1.0	.....
Arizona	9.7	1.9	2.1	9.7	1.9	2.1	10.6	5.0	2.3
Utah	5.5	0.7	0.8	5.8	0.7	0.8	3.4	0.9	1.2
Nevada	6.5	1.0	0.5	6.5	1.0	0.5	6.5	3.1	.....
PACIFIC	4.5	1.2	0.7	5.0	1.2	0.7	2.7	1.1	0.4
Washington	4.6	0.9	0.8	6.4	0.9	1.3	3.8	0.9	0.4
Oregon	5.9	1.4	1.1	6.2	1.4	1.1	4.4	1.3	.....
California	4.3	1.2	0.7	4.8	1.2	0.7	1.9	1.7	1.1

It appears from Table 87 that for all plants in the United States the average lighting rate is 5.5 cents, the average power rate 1.2 cents, and the average charge for current supplied to other public service corporations seven-tenths of 1 cent. The average rates for all commercial plants vary from the United States total only in one particular, the average lighting rate being 5.6 cents instead of 5.5 cents. For this group of stations the highest lighting rates are found in New Mexico (10.7 cents), North Dakota (10 cents), South Dakota (9.9 cents), and Arizona (9.7 cents). The lowest lighting rates are reported by West Virginia (3 cents), Alabama (3.7 cents), Ohio (3.8 cents), Minnesota (4.2 cents), Louisiana (4.4 cents), Tennessee (4.4 cents), and California (4.8 cents). The New England division reports the highest lighting rate, 6.9 cents, while the South Atlantic and the Pacific return the lowest, 5 cents. In individual instances much higher rates than those mentioned are found—as high as 25 cents in some small plants.

The lowest average rate for power is met with in the Mountain division (eight-tenths of 1 cent) and South Atlantic (nine-tenths of 1 cent), while the highest average rates are found in the West South Central (2.1 cents), New England (1.7 cents), and East North Central (1.6 cents). The individual states which report high power rates are, in general, the same as those which have high lighting rates, North Dakota leading with 4.3 cents, followed by New Mexico (3.4 cents) and South Dakota (3 cents). Commercial plants in several states, however, report an average power rate under 1 cent. These states are Montana (six-tenths of 1 cent), Alabama (seven-tenths of 1 cent), Utah (seven-tenths of 1 cent), New York (seven-tenths of 1 cent), North and South Carolina (eight-tenths of 1 cent), Maine (eight-tenths of 1 cent), Idaho (eight-tenths of 1 cent), and Washington (nine-tenths of 1 cent). All divisions except the West South Central appear to supply current to other companies for a rate of less than 1 cent per kilowatt hour. Commercial plants in the West South Central division charge an average rate of 1 cent, while in the East South Central the lowest rate, three-tenths of 1 cent, occurs. Several states—Delaware, Maryland, Tennessee, Montana, Minnesota, Iowa, and Nevada—report a rate of five-tenths of 1 cent or less.

The averages for municipal plants show some wide variations from the general average for the United States, and on account of the condition of many of the schedules received are less dependable than the corresponding rates of commercial plants. The lighting rate, which is based on the total income from sale of current plus the estimated value of free service, as reported by the plants is 4.9 cents as opposed to 5.6 cents for commercial stations. This slightly lower rate can readily be accounted for by the fact that so large a portion of the business of the average publicly owned plant consists in furnishing street lighting. Further, on account of the small areas served, heavy investment in distribution lines is not incurred, nor

in many cases are the current losses in distribution so great as is met with in commercial stations. Finally, it appears from the schedules that municipal plants are disposed to underestimate the amount of current lost in distribution for two reasons: First, because their current is not, as a rule, so carefully metered either at the station or on the consumers' premises, and; secondly, because the large percentage of current which is supplied for street lighting can not be measured at the lamp terminals. When the municipality is financing the operation of the plant, it is sometimes considered unnecessary to watch these matters so closely as must be done in commercial stations. Hence it no doubt frequently happens that a considerable quantity of current which is actually lost in distribution is reported as "sold" by municipal plants. Thus the average lighting rate would appear lower than it really is because of the fact that there will be a relatively larger divisor for a given amount of income.

The West South Central division and the West North Central division report the highest average lighting rate for municipal plants, 7.8 cents and 7.6 cents, respectively. The states of Rhode Island, South Dakota, New Mexico, Arizona, New Hampshire, and Wyoming all report an average lighting rate in excess of 10 cents. The lowest lighting rate for municipal plants is found in California (1.9 cents), Illinois (2.4 cents), Utah (3.4 cents), Ohio (3.8 cents), and Washington (3.8 cents). These low rates are, in general, explained by local conditions. In California the number of stations is comparatively few, and one or two large plants which utilized hydroelectric power largely influenced the state average. In Illinois the extremely large Chicago municipal plants, which confine their activities solely to municipal lighting and the supply of power for municipal uses, but which do no general commercial business and which are consequently operated at a very low cost, seriously affect the state average. In Washington water power is widely used, and the plant in Seattle causes the state average to be out of line with what might be considered the normal figure. In Ohio, also, the large street-lighting plant of Columbus reports a very low estimated value of free service, and the Cleveland plant, operating in a compact and limited area, also reports unusually low rates.

The average power rate charged by municipal stations, 1.8 cents, is 50 per cent higher than the average reported by commercial plants, while the rate for current sold to other companies, 1.5 cents, is more than twice as high as that in the other group. The lowest power rates are reported by plants in the states of Washington (nine-tenths of 1 cent), Utah (nine-tenths of 1 cent), New Mexico (1 cent), and Idaho (1 cent). The highest rates, on the other hand, occur in Wyoming (30.9 cents), New Hampshire (6.5 cents), North Dakota (5.4 cents), Arizona (5 cents), and Louisiana (4.8 cents). The extraordinarily high Wyoming figure results from one of the few schedules in the state which reports unusual conditions. Three states—Washington, Texas, and Kentucky—report a rate of 1 cent or less per kilowatt hour for current supplied to other companies, while the maximum figures range as high as 8.6 cents. There are also 19 states in which municipal plants report no sales of current to other companies.

Net income and financial results of operation.—From the computation for the total expenses which have been made, it appears that commercial stations received a net income of $91,506,626 during the year 1917, which is equivalent to 3.1 per cent on the reported value of plant and equipment. Out of this sum dividends were paid amounting to $64,589,321, leaving a balance of $26,917,305 to be carried to surplus or otherwise disposed of.

Municipal plants in 1917 report a net income, after the estimated value of free service has been included, of $8,819,307, which is equivalent to 6.9 per cent of the value of plant and equipment. Though this relatively high showing on the basis of the investment value is due in large measure to the low investment accounts returned by municipal plants, yet attention should be called in this connection to the fact that municipal plants do not incur a number of important expenses which must be met by commercial stations. In the first place, they are practically free from taxation, whereas the former pay nearly $30,000,000 under this head. Secondly, they have no salaried officers of corporations, while commercial plants pay more than $5,000,000 for such salaries. If an allowance were made for these two items alone, for comparative purposes it would be necessary to deduct $35,000,000 from the reported expenses of commercial stations, an operation which would increase the net income by an equal amount, so that the rate would be equivalent to 4.3 per cent on the value of plant and equipment instead of 3.1 per cent. Numerous smaller charges also are frequently escaped by municipal plants. The smaller ones customarily occupy office space in public buildings and thus save on rent. They also frequently pay no insurance and receive services of different kinds from other municipal departments without incurring any financial obligation. In those cases in which bonds have been paid off by means of appropriations from the tax levy they are relieved of a large amount of interest payments; and it should be recalled that in 1917, 18 per cent of the entire expenses of commercial plants were interest payments, while the expenses for municipal plants amounted to only 7.8 per cent of the total.

A large number of plants in both groups were operated at a loss in 1917. The total number was 1,164, of which 761 were commercial and 403 municipal. In other words, 18 per cent of all commercial stations and 17.4 per cent of municipal stations, after the estimated value of free service had been allowed for, were operated at a deficit during the year.

CHAPTER IX.—EMPLOYEES, SALARIES, AND WAGES.

Character of the statistics.—As in 1912, an effort was made in 1917 to secure the representative number of classified employees in the service of the various central stations during the month of September. The date arbitrarily chosen was September 29 in 1917 and September 16 in 1912. At the first two censuses, in 1902 and 1907, the average number of employees was called for. Since, however, it proved to be extremely difficult for many plants to return a true average, this method of calling for the data was for practical reasons given up. Owing, therefore, to the change in method of collecting these statistics, the 1907 figures are not wholly satisfactory for purposes of comparison with the two later dates, though they may be regarded as approximately correct.

It should further be stated that the schedules call only for those employees who are *regularly* in the service of the different stations. Accordingly, those who are engaged primarily in making extensions and in new construction work are presumably excluded from the census returns, as their services are properly chargeable to the capital account. It must, however, be admitted that in many cases it is practically impossible for stations to make the required separation, and as a result the data will not always be accurate. Further, particularly in the case of composite stations, it is sometimes an extremely difficult matter to segregate properly the employees engaged in one part of the business from those engaged in the electric plants. In such cases all that can be secured are reasonable estimates. Finally, in many small plants, particularly those operating under municipal ownership, there are a number of part-time employees whose yearly compensation appears to be abnormally low. In such cases, when the condition was perfectly evident on the schedules, those employees who apparently devoted a small portion of their time to the service of the electric plant were eliminated in preparing the general tabulations and their wages charged to "all other" expenses. Thus more nearly accurate wage rates could be secured. As the data are presented in 1917 it is probable that the wage statistics are more nearly correct than at any preceding period, and it is also probable that more satisfactory comparisons can be made between the rates paid by commercial and municipal stations.

Comparative statistics of employees, salaries, and wages.—In Table 88 is shown for all stations, as well as for commercial and municipal plants separately, the total number of the various classes of employees, together with the amount of compensation paid to each class, as well as the per cent of increase in the various items since 1907. Commercial plants at this date reported almost 90 per cent, or 94,679 out of a total of 105,541 of all employees, and paid about 91 per cent of all salaries and wages. At this date, also, 65.6 per cent of all commercial-station employees are classified as "wage earners," that is, those who are engaged in a subordinate capacity doing other than office work; 27.8 per cent were clerks, stenographers, etc.; 4.2 per cent superintendents and managers; while the salaried officers constituted only 2.5 per cent of the total. These officers, however, received 5.9 per cent of all salaries and wages paid, while superintendents and managers received 8.4 per cent, and clerks and wage earners 25.5 per cent and 60.2 per cent, respectively.

Table 88 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—EMPLOYEES, SALARIES, AND WAGES: 1917, 1912, AND 1907.

CLASS.	Total.			Commercial.			Municipal.			Per cent of increase: 1907–1917.		
	1917	1912	1907	1917	1912	1907	1917	1912	1907	Total.	Commercial.	Municipal.
Total:												
Number	105,541	79,335	47,632	94,679	71,395	42,066	10,862	7,940	5,566	121.6	125.1	95.1
Salaries and wages	$95,241,858	$61,161,941	$35,420,324	$86,473,496	$55,658,515	$31,935,309	$8,768,362	$5,503,426	$3,485,015	168.9	170.8	151.6
Salaried employees:												
Officers of corporations—												
Number	2,323	2,181	1,761	2,323	2,181	1,761	.....	.....	.....	31.9	31.9	.....
Salaries	$5,136,058	$3,839,136	$2,202,028	$5,136,058	$3,839,136	$2,202,028	.....	.....	.....	133.2	133.2	.....
Superintendents and managers—												
Number	5,218	4,792	4,357	3,951	3,629	3,268	1,267	1,163	1,089	19.8	20.9	16.3
Salaries	$8,670,814	$6,482,749	$5,058,236	$7,287,596	$5,397,004	$4,243,307	$1,383,218	$1,085,745	$814,929	71.4	71.7	69.7
Clerks, stenographers, and other salaried employees—												
Number	27,865	19,120	6,872	26,318	18,067	6,346	1,547	1,053	526	305.5	314.7	194.1
Salaries	$22,980,829	$13,985,419	$4,473,523	$22,015,212	$13,400,937	$4,293,620	$965,617	$584,482	$179,903	413.7	412.7	436.7
Wage earners:												
Number	[1] 70,135	[2] 53,242	[3] 34,642	[1] 62,087	[2] 47,518	[3] 30,691	[1] 8,048	[2] 5,724	[3] 3,951	102.4	102.3	103.7
Wages	$58,454,157	$36,854,637	$23,686,537	$52,034,630	$33,021,438	$21,196,354	$6,419,527	$3,833,199	$2,490,183	146.8	145.5	157.8

[1] Number Sept. 29, 1917, or nearest representative day. [2] Number Sept. 16, 1912, or nearest representative day. [3] Average number.

Municipal stations, of course, report no salaried officers of corporations. Their total number of so-called salaried employees is 2,814, or 25.9 per cent of all their employees, as compared with 32,592, or 34.4 per cent of the total for commercial stations. They also receive 26.8 per cent of the salaries and wages paid. Hence it is apparent that there is little difference between the average rates of compensation paid to salaried employees and wage earners of municipal stations.

It is interesting to find that in every case salaries and wages have increased much more rapidly in both commercial and municipal stations than has the number of employees. The most rapid increase, both in number of employees and in amount of salaries paid, is found to have taken place in the group of clerks, stenographers, and other salaried employees; the lowest rate of increase, both in number and in total compensation, is found in the case of superintendents and managers, while the most rapid rate of increase in salaries paid relative to the increase in the number receiving such salaries is shown for officers of corporations.

Table 89 gives a comparative statement of the average compensation received by the different classes of employees in commercial and municipal stations at the last three census periods. Several significant relations are evident. First, the average compensation of all employees in commercial stations, $913, is considerably higher than the corresponding average for municipal stations, which report only $807. Upon examining the different classes of employees, however, it appears that the widest variations between the two groups exist in the salaries which are paid to superintendents and managers. The average for commercial stations is $1,844 and for municipal plants only $1,092. This condition is partially, though not wholly, due to the fact that municipal plants in general are much smaller than the other group, and hence do not require as highly trained and able managers. Another noticeable difference exists in the compensation paid to office help, the average for commercial stations being $837, while the average for municipal plants is only $624. The average wages paid, however, are not far apart in either case, being $838 for the former and $798 for the latter.

Table 89 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—AVERAGE SALARIES AND WAGES: 1917, 1912, AND 1907.

CLASS.	Total.			Commercial.			Municipal.		
	1917	1912	1907	1917	1912	1907	1917	1912	1907
All employees	$902	$771	$744	$913	$780	$759	$807	$693	$626
Salaried employees—									
Officers of corporations	2,211	1,760	1,250	2,211	1,760	1,250	.....	.....	.....
Superintendents and managers	1,662	1,353	1,161	1,844	1,487	1,298	1,092	934	748
Clerks, stenographers, and other salaried employees	825	731	651	837	742	677	624	555	342
Wage earners	833	692	684	838	695	691	798	670	630

Some reference should also be made in this connection to the relative rate of increase in average compensation paid during the last five years, when wages and salaries have been advancing rapidly. It appears, accordingly, that the salaries of officers of corporations increased 25.6 per cent since 1912 and during the preceding five-year period the increase was 40.8 per cent. During the last five-year period, also, the salaries of superintendents and managers show an increase for commercial stations of 24 per cent. During the same period wage earners secured an advance of 20.6 per cent, while clerks, stenographers, and other office employees stand lowest in the list, with an advance of only 12.8 per cent. In municipal plants, also, relatively similar conditions are to be found. Here, however, wage earners head the list in the rate of increase in compensation, with an advance of 19.1 per cent since 1912. Superintendents and managers received an advance of 16.9 per cent, while the clerical force again lags behind with an advance of only 12.4 per cent. These figures furnish further evidence of the fact that it is the salaried employee with modest compensation who finds it most difficult to secure wage increases commensurate with the increased cost of living. The rapid rate of increase in average compensation of the office force in municipal plants from $342 in 1907 to $555 in 1912 is difficult to explain, but is doubtless accounted for largely by certain inaccuracies in the returns for the earlier period.

In Table 90 is given the amount of salaries and wages paid, by geographic divisions and by states, together with the rate of increase for the decade and for the five-year periods since 1907.

As is to be expected, the largest amount was expended in salaries and wages by the states of New York, Pennsylvania, Illinois, and California, which also report the highest proportion of wage earners. That situation in this regard has been the same at the last three census periods. During the last five years the rate of increase in the number of employees has been most rapid in Utah, 203 per cent; North Carolina, 103.3 per cent; and Arizona, 100.9 per cent. During the same period the rate of increase in the total amount paid for salaries and wages has been most marked in Virginia, 165.3 per cent; West Virginia, 164.2 per cent; Utah, 156.7 per cent; North Carolina, 142 per cent; Alabama, 109.8 per cent; Arizona, 105.3 per cent; and Wisconsin, 101.8 per cent. In nearly every state at all periods the rate of increase in total compensation has been more rapid than the rate of increase in the number of employees. For the period 1912–1917, however, six states—Rhode Island, Missouri, North Dakota, Mississippi, Idaho, and Utah—report a percentage growth in number of wage earners in excess of the increase in amount of wages paid.

Table 91 makes possible a more detailed study of conditions as they were found in 1917. In this table the classified employees, together with their compensation, are recorded according to geographic divisions

and states. Here again it is found that in practically every instance the states of New York, Pennsylvania, Illinois, and California lead the list. In the number of clerks and stenographers, however, Massachusetts stands third, ranking ahead of Pennsylvania and California, but in the total compensation paid to this group of employees, that state ranks fourth. Further comments on the table are unnecessary.

CENTRAL ELECTRIC STATIONS—TOTAL NUMBER OF EMPLOYEES AND SALARIES AND WAGES, BY GEOGRAPHIC DIVISIONS AND STATES: 1917, 1912, AND 1907.

Table 90

DIVISION AND STATE.	1917		1912		1907		PER CENT OF INCREASE.[1]					
							1907–1917		1912–1917		1907–1912	
	Number.	Salaries and wages.	Number.	Salaries and wages.	Number.	Salaries and wages.	Number.	Salaries and wages.	Number.	Salaries and wages.	Number.	Salaries and wages.
UNITED STATES	105,541	$95,241,858	79,335	$61,161,941	47,632	$35,420,324	121.6	168.9	33.0	55.7	66.6	72.7
GEOGRAPGIC DIVISIONS:												
New England	10,157	8,763,855	7,352	5,604,983	5,088	3,899,439	99.6	124.7	38.2	56.4	44.5	43.7
Middle Atlantic	32,048	29,735,092	24,022	18,612,382	13,977	10,431,544	129.3	185.0	33.4	59.8	71.9	78.4
East North Central	24,361	22,850,710	19,233	14,085,033	10,324	7,213,771	136.0	216.8	26.7	62.2	86.3	95.3
West North Central	12,231	9,612,183	7,892	5,875,467	5,007	3,538,044	144.3	171.7	55.0	63.6	57.6	66.1
South Atlantic	5,948	4,619,838	4,317	2,780,706	2,622	1,692,982	126.8	172.9	37.8	66.1	64.6	64.2
East South Central	3,296	2,412,130	2,426	1,641,770	1,632	919,524	102.0	162.3	35.9	46.9	48.7	78.5
West South Central	4,757	3,723,235	3,655	2,543,847	2,474	1,594,619	92.3	133.5	30.2	46.4	47.7	59.5
Mountain	4,828	4,716,199	3,090	2,927,122	2,028	1,819,343	138.1	159.2	56.2	61.1	52.4	60.9
Pacific	7,915	8,808,616	7,348	7,090,631	4,480	4,311,058	76.7	104.3	7.7	24.2	64.0	64.5
NEW ENGLAND:												
Maine	772	619,739	620	402,394	502	308,006	53.8	101.2	22.7	54.0	25.3	30.6
New Hampshire	732	603,027	578	434,617	422	286,749	73.4	110.3	26.6	38.7	37.0	51.6
Vermont	443	350,735	340	219,897	297	188,780	49.2	85.8	30.3	59.5	14.5	16.5
Massachusetts	5,482	4,557,883	3,954	2,981,043	2,672	2,235,647	105.2	103.9	38.6	52.9	48.0	33.3
Rhode Island	790	760,323	511	512,771	450	350,605	75.6	116.9	54.6	48.3	13.6	46.3
Connecticut	1,938	1,872,148	1,340	1,054,261	745	529,652	160.1	253.5	44.6	77.6	79.9	99.0
MIDDLE ATLANTIC:												
New York	16,248	15,314,748	13,733	11,034,898	7,716	5,819,617	110.6	163.2	18.3	38.8	78.0	89.6
New Jersey	5,065	4,821,852	2,989	2,479,219	1,759	1,370,506	187.9	251.8	69.4	94.5	69.9	80.9
Pennsylvania	10,735	9,598,492	7,300	5,098,265	4,502	3,241,421	138.4	196.1	47.0	88.3	62.2	57.3
EAST NORTH CENTRAL:												
Ohio	4,714	4,143,688	3,131	2,264,892	2,157	1,543,925	118.5	168.4	50.6	83.0	45.2	46.7
Indiana	2,897	2,371,606	2,269	1,525,875	1,618	969,263	79.0	144.7	27.7	55.4	40.2	57.4
Illinois	9,294	8,636,523	8,036	6,223,882	3,902	3,032,721	138.2	184.8	15.6	38.8	105.9	105.2
Michigan	4,738	5,223,067	3,876	2,843,371	1,780	1,126,813	166.2	363.5	22.2	83.7	117.8	152.3
Wisconsin	2,718	2,475,826	1,921	1,227,013	867	541,049	213.5	357.6	41.5	101.8	121.6	126.8
WEST NORTH CENTRAL:												
Minnesota	2,520	2,011,137	1,568	1,222,493	1,062	755,778	137.3	166.1	60.7	64.5	47.6	61.8
Iowa	2,083	1,679,790	1,329	921,096	855	547,177	143.6	207.0	56.7	82.4	55.4	68.3
Missouri	3,767	2,776,597	2,434	1,883,844	1,800	1,306,640	109.3	112.5	54.8	47.4	35.2	44.2
North Dakota	419	343,746	232	197,983	150	113,383	179.3	203.2	80.6	73.6	54.7	74.6
South Dakota	449	411,790	338	264,159	169	127,143	165.7	223.9	32.8	55.9	100.0	107.8
Nebraska	1,227	979,345	882	598,703	404	313,427	203.7	212.5	39.1	63.6	118.3	91.0
Kansas	1,766	1,409,778	1,109	787,189	567	374,496	211.5	276.4	59.2	79.1	95.6	110.2
SOUTH ATLANTIC:												
Delaware, Maryland, and District of Columbia	1,399	1,270,721	1,249	936,805	1,024	759,508	36.6	67.3	12.0	35.6	22.0	23.3
Virginia	561	453,322	341	170,884	178	99,060	215.2	357.6	64.5	165.3	91.6	72.5
West Virginia	753	675,094	439	255,471	262	168,633	187.4	300.3	71.5	164.2	67.6	51.5
North Carolina	921	631,925	453	261,078	248	131,013	271.4	382.3	103.3	142.0	82.7	99.3
South Carolina	721	533,850	683	452,456	261	145,357	176.2	267.3	5.6	18.0	161.7	211.3
Georgia	915	583,801	697	417,950	384	232,711	138.3	150.9	31.3	39.7	81.5	79.6
Florida	678	471,035	455	286,053	265	156,700	155.8	200.6	49.0	64.7	71.7	82.5
EAST SOUTH CENTRAL:												
Kentucky	1,031	759,383	907	635,829	585	301,794	76.2	151.6	13.7	19.4	55.0	110.7
Tennessee	1,008	778,651	656	455,212	416	247,764	142.3	214.3	53.6	71.0	57.7	83.7
Alabama	806	602,050	456	286,936	343	208,533	135.0	188.7	76.8	109.8	32.9	37.6
Mississippi	451	272,046	407	263,793	288	161,433	56.6	68.5	10.8	3.1	41.3	63.4
WEST SOUTH CENTRAL:												
Arkansas	456	338,417	360	242,267	244	157,814	86.9	114.4	26.7	39.7	47.5	53.5
Louisiana	669	530,515	489	371,034	541	382,982	23.6	38.5	36.8	43.0	−9.6	−3.1
Oklahoma	1,101	885,880	785	581,580	414	264,604	165.9	234.8	40.2	52.3	89.6	119.8
Texas	2,531	1,968,423	2,021	1,348,966	1,275	789,219	98.5	149.4	25.2	45.9	58.5	70.9
MOUNTAIN:												
Montana	732	969,498	514	625,918	319	360,768	129.5	168.7	42.4	54.9	61.1	73.5
Idaho	469	450,753	324	334,063	188	171,125	149.5	163.4	44.8	34.9	72.3	95.2
Wyoming	261	259,786	163	149,356	96	77,811	.....	233.9	60.1	73.9	.....	91.9
Colorado	1,269	1,269,608	1,166	999,864	918	775,045	38.2	63.8	8.8	27.0	27.0	29.0
New Mexico	256	223,510	158	119,088	83	66,981	208.4	233.7	62.0	87.7	.....	77.8
Arizona	436	451,163	217	219,798	148	130,663	194.6	245.3	100.9	105.3	46.6	68.2
Utah	1,215	937,869	401	365,309	198	159,686	513.6	487.3	203.0	156.7	102.5	128.8
Nevada	190	154,012	147	113,636	78	77,264	.....	99.3	29.2	35.5	.....	47.1
PACIFIC:												
Washington	1,112	1,093,365	1,078	880,309	885	800,441	25.6	36.6	3.2	24.2	21.8	10.0
Oregon	636	583,195	532	387,119	467	416,424	36.2	40.0	19.5	50.6	13.9	−7.0
California	6,167	7,132,056	5,738	5,823,203	3,128	3,094,193	97.2	130.5	7.5	22.5	83.4	88.2

[1] A minus sign (−) denotes decrease. Percentages are omitted when base is less than 100.

CENTRAL ELECTRIC STATIONS—EMPLOYEES AND SALARIES AND WAGES, BY GEOGRAPHIC DIVISIONS AND STATES: 1917.

Table 91

DIVISION AND STATE.	AGGREGATE.		SALARIED EMPLOYEES.								WAGE EARNERS.	
			Total.		Officers of corporations.		Superintendents and managers.		Clerks, stenographers, and other salaried employees.			
	Number.	Salaries and wages.	Number.	Salaries.	Number.	Salaries.	Number.	Salaries.	Number.	Salaries.	Number.	Wages.
UNITED STATES	105,541	$95,241,858	35,406	$36,787,701	2,323	$5,136,058	5,218	$8,670,814	27,865	$22,980,829	70,135	$58,454,157
GEOGRAPHIC DIVISIONS:												
New England	10,157	8,763,855	4,172	4,063,488	358	688,986	426	898,333	3,388	2,476,169	5,985	4,700,367
Middle Atlantic	32,048	29,735,092	10,313	11,048,555	550	1,474,704	988	2,106,990	8,775	7,466,861	21,735	18,686,537
East North Central	24,361	22,850,710	9,230	9,537,466	443	1,027,522	1,131	1,876,674	7,656	6,633,270	15,131	13,313,244
West North Central	12,231	9,612,183	3,093	2,863,231	231	366,301	803	1,081,030	2,059	1,415,900	9,138	6,748,952
South Atlantic	5,948	4,619,838	1,888	1,793,731	202	340,667	550	676,399	1,136	776,665	4,060	2,826,107
East South Central	3,206	2,412,130	865	801,956	81	129,061	255	302,316	529	370,579	2,431	1,610,174
West South Central	4,757	3,723,235	1,612	1,391,233	130	232,098	410	489,559	1,072	669,576	3,145	2,332,002
Mountain	4,828	4,716,199	1,583	1,862,440	163	347,935	308	515,785	1,112	998,720	3,245	2,853,759
Pacific	7,915	8,808,616	2,650	3,425,601	165	528,784	347	723,728	2,138	2,173,089	5,265	5,383,015
NEW ENGLAND:												
Maine	772	619,739	295	248,337	77	60,093	68	85,547	150	93,697	477	371,402
New Hampshire	732	603,027	206	190,002	49	68,151	38	51,221	119	70,630	526	413,025
Vermont	443	350,735	142	117,594	25	23,675	43	48,802	74	45,117	301	233,141
Massachusetts	5,482	4,557,883	2,844	2,624,956	124	298,610	185	491,240	2,535	1,835,106	2,638	1,932,927
Rhode Island	790	760,323	200	272,556	22	66,996	21	44,142	157	161,418	590	487,767
Connecticut	1,938	1,872,148	485	610,043	61	162,461	71	177,381	353	270,201	1,453	1,262,105
MIDDLE ATLANTIC:												
New York	18,248	15,314,748	6,218	6,553,687	267	798,752	528	1,155,556	5,423	4,599,379	10,030	8,761,061
New Jersey	5,065	4,821,852	1,300	1,531,616	59	214,217	108	238,758	1,133	1,078,641	3,765	3,290,236
Pennsylvania	10,735	9,598,492	2,795	2,963,252	224	461,735	352	712,676	2,219	1,788,841	7,940	6,635,240
EAST NORTH CENTRAL:												
Ohio	4,714	4,143,688	1,339	1,278,813	99	237,506	238	376,452	1,002	664,855	3,375	2,864,875
Indiana	2,897	2,371,606	752	758,244	95	177,552	163	207,927	494	372,765	2,145	1,613,362
Illinois	9,294	8,636,523	4,723	4,903,549	107	330,886	342	672,885	4,274	3,899,778	4,571	3,732,974
Michigan	4,738	5,223,067	1,716	1,982,171	62	160,903	234	419,401	1,420	1,401,807	3,022	3,240,896
Wisconsin	2,718	2,475,826	700	614,689	80	120,615	154	200,009	466	294,065	2,018	1,861,137
WEST NORTH CENTRAL:												
Minnesota	2,520	2,011,137	608	628,147	47	86,242	144	230,501	417	311,404	1,912	1,382,990
Iowa	2,083	1,679,790	653	594,631	55	70,478	167	225,801	431	298,352	1,430	1,085,159
Missouri	3,767	2,776,597	817	674,369	39	74,368	142	185,697	636	414,304	2,950	2,102,228
North Dakota	419	343,746	98	101,309	11	15,412	38	53,788	49	32,109	321	242,437
South Dakota	449	411,780	120	127,295	21	17,790	47	68,962	52	40,543	329	284,495
Nebraska	1,227	979,345	329	332,054	32	64,330	109	127,197	188	140,527	898	647,291
Kansas	1,766	1,409,778	468	405,426	26	37,681	156	189,084	286	178,661	1,298	1,004,352
SOUTH ATLANTIC:												
Delaware, Maryland, and District of Columbia	1,309	1,270,721	639	592,869	32	86,598	72	119,916	535	386,355	760	677,852
Virginia	561	453,322	149	151,110	20	35,215	54	65,076	75	50,819	412	302,212
West Virginia	753	675,094	183	204,247	31	43,681	66	93,562	86	67,004	570	470,847
North Carolina	921	631,925	239	240,617	43	61,264	102	124,101	94	55,252	682	391,308
South Carolina	721	533,350	205	216,386	27	54,354	71	83,232	107	78,800	516	317,464
Georgia	915	583,891	260	208,416	28	37,851	114	108,440	118	62,125	655	375,475
Florida	678	471,035	213	180,086	21	21,704	71	82,072	121	76,310	465	290,949
EAST SOUTH CENTRAL:												
Kentucky	1,031	759,383	316	271,701	40	61,051	73	96,512	203	114,138	715	487,682
Tennessee	1,008	778,651	282	301,805	23	48,814	92	105,607	167	147,384	726	476,846
Alabama	806	602,050	157	151,293	8	11,256	54	61,916	95	78,121	649	450,757
Mississippi	451	272,046	110	77,157	10	7,940	36	38,281	64	30,936	341	194,889
WEST SOUTH CENTRAL:												
Arkansas	456	338,417	184	143,970	22	27,549	65	66,551	97	49,870	272	194,447
Louisiana	669	530,515	247	210,944	14	29,084	52	59,568	181	122,292	422	319,571
Oklahoma	1,101	885,880	318	287,466	34	42,771	93	120,512	191	124,183	783	598,414
Texas	2,531	1,968,423	863	748,853	60	132,694	200	242,928	603	373,231	1,668	1,219,570
MOUNTAIN:												
Montana	732	960,498	221	361,105	20	93,087	66	122,553	135	145,465	511	608,393
Idaho	469	450,753	229	249,189	15	33,866	22	40,188	192	175,135	240	201,564
Wyoming	261	259,786	103	104,013	14	13,748	29	45,823	60	44,442	158	155,773
Colorado	1,269	1,269,608	373	418,430	33	68,146	83	141,706	257	208,578	896	851,178
New Mexico	256	223,510	92	76,766	26	16,165	28	37,888	38	22,713	164	146,744
Arizona	436	451,163	164	188,245	30	53,415	34	54,707	100	80,123	272	262,918
Utah	1,215	937,869	338	400,617	17	51,866	33	58,928	288	289,823	877	537,252
Nevada	190	154,012	63	64,075	8	17,642	13	13,992	42	32,441	127	89,937
PACIFIC:												
Washington	1,112	1,093,365	330	329,567	26	40,468	55	81,142	249	207,947	782	763,808
Oregon	636	583,195	210	246,577	25	50,801	51	74,980	134	120,796	426	336,618
California	6,167	7,132,056	2,110	2,849,467	114	437,515	241	567,606	1,755	1,844,346	4,057	4,282,589

Output of central electric stations per employee.—An attempt has been made for this census to show in a detailed way what may be termed the "labor efficiency" of central electric stations, classified according to the form of ownership and according to whether they generate current or merely purchase from other companies. While satisfactory data are not available for 1907, the figures for 1912 are somewhat more dependable, and comparisons can, therefore, best be made only for the last two census periods.

As shown in Table 92, the average amount of current generated per employee for all stations was 241,028 kilowatt hours in 1917, as compared with only 145,826 kilowatt hours in 1912. To indicate the condition correctly, however, the entire output of such stations, including current purchased as well as generated,

should be considered. Accordingly, we find that the average output of such stations per employee, including current purchased for distribution to customers, as well as current generated by the plant itself, was 299,072 kilowatt hours in 1917, and 174,637 kilowatt hours in 1912. The average for plants purchasing all current has apparently decreased from 235,388 kilowatt hours in 1912 to only 210,497 kilowatt hours in 1917. This decrease is accounted for by the change already referred to in other portions of the report, which took place in some of the large stations in New York. With these general figures for all stations in the United States should be compared the data for hydroelectric stations as presented in Chapter III. In these large plants the average number of kilowatt hours generated per employee was 544,137, and the average total output per employee was 625,983 kilowatt hours.

Table 92 OUTPUT OF CENTRAL ELECTRIC STATIONS AND AVERAGE OUTPUT PER EMPLOYEE: 1917, 1912, AND 1907.

DIVISION.[1]	Census year.	Number of employees.			Output of stations (kilowatt hours).			Average output per employee (kilowatt hours).		Average amount generated per employee (kilowatt hours).
		Total.	In plants generating all or part of current.	In plants purchasing all current.	Plants generating all or part of current.		Plants purchasing all current.	Plants generating all or part of current.	Plants purchasing all current.	
					Generated.	Purchased.				
United States	1917	105,541	99,666	5,875	25,438,303,272	4,369,075,114	1,236,670,848	299,072	210,497	241,028
	1912	79,335	73,940	5,395	11,569,109,885	1,343,583,623	1,269,918,982	174,637	235,388	145,826
	1907	47,632	(2)	(2)	5,862,276,737	(2)	(2)	.....	.....	123,074
New England	1917	10,157	9,487	670	1,835,584,072	433,356,678	144,754,181	239,163	216,051	180,721
	1912	7,352	6,838	514	865,379,442	28,353,032	98,468,204	132,163	191,572	117,707
	1907	5,088	(2)	(2)	473,802,067	(2)	(2)	.....	.....	93,121
Middle Atlantic	1917	32,048	30,401	1,647	7,659,317,763	1,486,928,937	430,451,842	300,853	261,355	238,995
	1912	24,022	21,754	2,268	3,548,605,305	206,298,986	783,105,328	172,608	345,285	147,723
	1907	13,977	(2)	(2)	2,009,304,160	(2)	(2)	.....	.....	143,758
East North Central	1917	24,361	22,993	1,368	5,757,150,135	348,216,198	267,389,624	265,532	195,460	236,327
	1912	19,233	18,102	1,131	2,527,964,097	106,610,018	170,132,494	145,540	150,427	131,439
	1907	10,324	(2)	(2)	1,075,933,354	(2)	(2)	.....	.....	104,217
West North Central	1917	12,231	11,553	678	1,776,475,523	637,345,129	153,162,909	208,935	225,904	145,244
	1912	7,892	7,239	653	712,595,442	71,370,825	112,164,613	108,298	171,768	90,293
	1907	5,007	(2)	(2)	386,180,647	(2)	(2)	.....	.....	77,128
South Atlantic	1917	5,948	5,470	478	1,745,295,143	340,637,916	69,527,318	382,437	145,455	293,426
	1912	4,317	4,037	280	729,896,397	369,514,227	38,202,431	272,334	136,437	169,075
	1907	2,622	(2)	(2)	266,437,175	(2)	(2)	.....	.....	101,616
East South Central	1917	3,296	3,167	129	1,048,814,771	337,120,228	18,470,623	437,618	143,188	318,208
	1912	2,426	2,351	75	227,664,808	7,988,926	7,959,846	100,236	106,131	93,844
	1907	1,632	(2)	(2)	118,031,967	(2)	(2)	.....	.....	72,691
West South Central	1917	4,757	4,552	205	482,645,862	113,661,810	43,941,915	130,999	214,351	101,460
	1912	3,655	3,634	21	233,947,656	37,089,053	1,674,415	74,584	79,734	64,008
	1907	2,474	(2)	(2)	138,755,643	(2)	(2)	.....	.....	56,086
Mountain	1917	4,828	4,547	281	2,036,194,737	301,966,372	36,845,353	514,221	131,122	421,74
	1912	3,090	2,888	202	845,393,882	160,585,745	27,615,785	348,331	136,712	273,590
	1907	2,028	(2)	(2)	381,032,187	(2)	(2)	.....	.....	187,886
Pacific	1917	7,915	7,496	419	3,096,825,266	363,841,846	72,127,083	461,669	172,141	391,260
	1912	7,348	7,097	251	1,877,662,856	345,772,811	30,595,866	313,292	121,896	255,534
	1907	4,480	(2)	(2)	1,012,199,537	(2)	(2)	.....	.....	225,937

[1] See p. 18 for states composing the several geographic divisions. [2] Figures not available.

It is perhaps more significant to note some of the averages for municipal and commercial stations taken separately. Accordingly, it appears that the average amount of current generated per employee in the former is only 95,684 kilowatt hours, while in the latter it is 257,702 kilowatt hours. The average output of the so-called generating stations, including purchased current, is 113,729 for municipal plants and 318,387, or nearly three times as large, for commercial stations. The difference was not so marked in 1912. In 1917, also, the average output per employee of plants purchasing all current was 243,165 kilowatt hours for commercial stations and 111,350 kilowatt hours for municipal plants.

Those geographic divisions which led in the average output per employee for commercial generating stations are the Mountain division, 535,687 kilowatt hours; East South Central, 527,159; Pacific, 486,942 kilowatt hours; and the South Atlantic, 458,093. Municipal plants report the highest output of generating stations per employee in the Pacific division, 254,772 kilowatt hours; in the East North Central, 150,524 kilowatt hours; and in the New England, 137,186 kilowatt hours. The highest averages for commercial plants are found in the states with extensive water-power development. The lowest average output per employee for this group of stations is reported under both classes of ownership in the West South Central division, where small oil and gas using plants are very common. The output in this division is 146,801 kilowatt hours for commercial stations and only 53,504 kilowatt hours for municipal plants. The largest average output per commercial station which purchases all current is found in the West North Central division, 296,884 kilowatt hours. This is closely followed by the Middle Atlantic, the East

North Central, the New England, and the West South Central divisions. Municipal purchasing plants report the highest average in the Pacific, 175,361 kilowatt hours, and the Middle Atlantic, 125,546 kilowatt hours. The lowest average for this kind of plant is reported by commercial stations in the Mountain division, 133,350 kilowatt hours, and by municipal stations in the East South Central division, 51,391 kilowatt hours.

Table 93 OUTPUT OF COMMERCIAL CENTRAL ELECTRIC STATIONS AND AVERAGE OUTPUT PER EMPLOYEE: 1917, 1912, AND 1907.

DIVISION.	Census year.	Number of employees.			Output of stations (kilowatt hours).			Average output per employee (kilowatt hours).		Average amount generated per employee (kilowatt hours).
		Total.	In plants generating all or part of current.	In plants purchasing all current.	Plants generating all or part of current.		Plants purchasing all current.	Plants generating all or part of current.	Plants purchasing all current.	
					Generated.	Purchased.				
United States	1917	94,679	90,260	4,419	24,308,983,183	4,338,662,287	1,074,545,276	318,387	243,165	257,702
	1912	71,395	66,583	4,812	11,031,583,155	1,317,617,940	1,207,304,288	185,471	250,894	154,515
	1907	42,066	(1)	(1)	5,572,813,949	(1)	(1)	.....	.....	132,478
New England	1917	9,533	8,972	561	1,776,289,676	422,000,426	135,425,719	245,016	241,400	186,331
	1912	6,850	6,376	474	826,143,047	36,497,608	94,893,001	135,295	200,196	120,605
	1907	4,731	(1)	(1)	420,903,003	(1)	(1)	.....	.....	95,308
Middle Atlantic	1917	31,458	29,890	1,568	7,618,232,163	1,485,696,667	420,533,674	304,581	268,197	242,172
	1912	23,545	21,292	2,253	3,519,216,083	206,203,491	781,767,031	174,968	346,989	149,468
	1907	13,529	(1)	(1)	1,983,341,586	(1)	(1)	.....	.....	146,697
East North Central	1917	20,992	20,245	747	5,348,721,569	343,004,990	197,237,840	281,142	264,040	254,798
	1912	16,592	15,761	831	2,280,324,043	103,015,236	135,477,620	151,218	163,030	137,435
	1907	8,159	(1)	(1)	960,308,248	(1)	(1)	.....	.....	117,699
West North Central	1917	9,874	9,415	459	1,623,567,900	633,810,940	136,269,850	239,764	296,884	164,429
	1912	6,476	5,876	600	659,867,731	71,171,803	109,120,292	122,879	181,867	100,505
	1907	4,124	(1)	(1)	342,800,564	(1)	(1)	.....	.....	83,123
South Atlantic	1917	4,628	4,390	238	1,669,198,197	341,829,401	39,885,454	458,093	167,586	360,674
	1912	3,327	3,154	173	680,571,054	369,399,444	25,555,820	332,901	147,722	204,560
	1907	1,924	(1)	(1)	236,136,778	(1)	(1)	.....	.....	122,732
East South Central	1917	2,666	2,558	108	1,012,378,561	336,095,376	17,391,411	527,159	161,032	379,737
	1912	1,924	1,855	69	195,999,962	7,986,426	7,664,531	109,966	111,080	191,871
	1907	1,194	(1)	(1)	97,074,576	(1)	(1)	.....	.....	81,302
West South Central	1917	3,953	3,781	172	441,694,042	113,361,810	40,357,001	146,891	234,634	111,736
	1912	3,117	3,103	14	211,050,496	36,428,503	859,127	79,755	61,366	67,709
	1907	2,219	(1)	(1)	125,947,056	(1)	(1)	.....	.....	56,758
Mountain	1917	4,578	4,329	249	2,017,395,528	301,684,882	33,204,041	535,687	133,350	440,652
	1912	*2,957*	*2,777*	*180*	*836,590,469*	*160,410,233*	*26,004,972*	*359,021*	*144,472*	*282,919*
	1907	1,962	(1)	(1)	375,815,364	(1)	(1)	.....	.....	191,547
Pacific	1917	6,997	6,680	317	2,801,595,547	361,177,795	54,240,295	486,942	171,105	413,262
	1912	6,607	6,389	218	1,830,820,270	326,505,196	25,961,894	337,662	119,091	277,103
	1907	4,233	(1)	(1)	1,000,486,774	(1)	(1)	.....	.....	236,354

[1] Figures not available.

Table 94 OUTPUT OF MUNICIPAL CENTRAL ELECTRIC STATIONS AND AVERAGE OUTPUT PER EMPLOYEE: 1917, 1912, AND 1907.

DIVISION.	Census year.	Number of employees.			Output of stations (kilowatt hours).			Average output per employee (kilowatt hours).		Average amount generated per employee (kilowatt hours).
		Total.	In plants generating all or part of current.	In plants purchasing all current.	Plants generating all or part of current.		Plants purchasing all current.	Plants generating all or part of current.	Plants purchasing all current.	
					Generated.	Purchased.				
United States	1917	10,862	9,406	1,456	1,039,320,089	39,412,827	162,125,572	113,729	111,350	95,684
	1912	7,940	7,357	583	537,526,730	25,965,683	62,614,694	76,593	107,491	67,699
	1907	5,566	(1)	(1)	289,462,788	(1)	(1)	.....	.....	52,006
New England	1917	624	515	109	59,294,396	11,356,252	9,328,471	137,186	85,582	95,023
	1912	502	462	40	39,236,395	1,855,424	3,575,293	81,856	89,380	78,160
	1907	357	(1)	(1)	22,899,064	(1)	(1)	.....	.....	64,143
Middle Atlantic	1917	590	511	79	41,085,000	1,232,270	9,918,168	84,771	125,546	69,637
	1912	477	462	15	29,389,222	95,495	1,338,297	63,820	89,220	61,613
	1907	457	(1)	(1)	25,962,574	(1)	(1)	.....	.....	56,811
East North Central	1917	3,369	2,748	621	408,428,566	5,211,208	70,151,784	150,524	112,966	121,231
	1912	2,641	2,341	300	247,640,054	3,594,782	34,654,874	107,319	115,516	93,768
	1907	2,165	(1)	(1)	115,625,106	(1)	(1)	.....	.....	53,407
West North Central	1917	2,357	2,138	219	152,907,623	3,534,189	16,893,059	73,172	77,137	64,874
	1912	1,416	1,363	53	61,727,711	199,022	3,044,321	45,434	57,440	43,593
	1907	883	(1)	(1)	43,380,083	(1)	(1)	.....	.....	49,128
South Atlantic	1917	1,320	1,080	240	76,096,946	4,808,515	29,641,864	74,912	123,508	57,649
	1912	990	883	107	49,325,343	114,783	12,646,611	55,991	118,103	49,824
	1907	698	(1)	(1)	30,309,397	(1)	(1)	.....	.....	43,410
East South Central	1917	630	609	21	36,436,210	1,024,852	1,979,212	61,512	51,391	57,835
	1912	*502*	*496*	*6*	*31,664,846*	*2,500*	*295,315*	*63,345*	*49,219*	*63,077*
	1907	438	(1)	(1)	21,557,391	(1)	(1)	.....	.....	49,218
West South Central	1917	804	771	33	40,951,820	300,000	3,584,914	53,504	108,634	50,935
	1912	538	531	7	22,897,160	660,550	815,288	44,365	116,470	42,560
	1907	255	(1)	(1)	12,808,587	(1)	(1)	.....	.....	50,230
Mountain	1917	250	218	32	18,889,209	281,490	3,641,312	87,939	113,791	75,557
	1912	133	111	22	8,803,413	175,512	1,610,813	80,891	73,219	66,191
	1907	66	(1)	(1)	5,216,823	(1)	(1)	.....	.....	79,043
Pacific	1917	918	816	102	205,229,719	2,664,051	17,886,788	254,772	175,361	223,562
	1912	741	708	33	46,842,586	19,267,615	4,633,972	93,376	140,423	63,215
	1907	247	(1)	(1)	11,712,763	(1)	(1)	.....	.....	47,420

[1] Figures not available.

CHAPTER X.—COMPARATIVE FINANCIAL AND OPERATING STATISTICS OF SELECTED GROUPS OF CENTRAL STATIONS.

Purpose and method of selection.—On account of the wide differences which exist between the various central electric light and power stations, resulting from the character of their ownership, their size, and the nature and extent of their business, as well as from the type of primary power used, it is a difficult matter to draw wholly satisfactory conclusions, based on the general statistics of the industry, regarding the financial and operating efficiency of typical stations. For this report, therefore, an attempt has been made to compile such statistics for carefully selected groups of stations, commercial and municipal, plants being arranged according to the kilowatt capacity of their dynamos and their total output in kilowatt hours and classified according to the source of primary power used, whether steam, water, oil, or gas. Typical plants purchasing all of their current have also been separated from those which generate current. From the resulting data here presented it is hoped that some profitable study can be made of the economics of large-scale production in the electric light and power business, together with a comparative survey of the conditions which result from the utilization of different kinds of primary power. Incidentally, also, it may be possible to draw some conclusions regarding the comparative efficiency of municipal and commercial plants, though the former are in most groups too few to serve as a basis for fair comparison.

The aim has been to select what may in general be termed "representative" plants, which, so far as the general nature of their business and conditions of operation are concerned, will lie between either extreme. The probable accuracy of the schedules returned by the various stations was also borne in mind. Accordingly, the following classes of plants were omitted from these special tabulations: All composite plants, for which the balance sheets and operating accounts are frequently questionable; unincorporated plants; plants which do only street lighting; plants which sell their entire output for power or to other companies, or both; and in the case of generating stations, none is included unless it produces 90 per cent or more of its total output of current. Further, in the case of steam plants, none was included which used any water power or any internal-combustion engines. No plant, in fact, was selected which used more than one type of primary power, with one exception. In order not to omit those important hydroelectric plants which merely use some motive power other than water as an auxiliary, a water-power plant was defined as one "of which at least 75 per cent of the primary power equipment consists of water wheels or turbines."

The selections having been made in this manner for the purpose of studying the comparative investment data, stations were arranged in 10 different capacity groups, ranging from under 200 kilowatts to over 100,000 kilowatts. The same stations were rearranged, according to their kilowatt output, into 11 groups, ranging from under 200,000 kilowatts to over 200,000,000 kilowatts, for the purpose of studying unit costs and income and general operating statistics.

The number of stations which meet all of the requirements imposed, and which, accordingly, are included in the special tabulations, are 840 commercial generating stations, consisting of 370 steam plants, 229 water power, 215 oil, and 26 gas; 591 municipal generating plants, comprising 285 steam, 52 water power, 240 oil, and 14 gas; 571 commercial purchasing stations, and 373 municipal purchasing stations. Hence these stations represent, in the case of generating stations, 25.1 per cent of all commercial and 33.3 per cent of all municipal stations generating current, while 65.1 per cent of all commercial purchasing plants are included and 68.9 per cent of the corresponding municipal plants.

Comparative value of plant and equipment of generating plant, grouped according to kilowatt capacity of dynamos.—In Table 95 are summarized the results of a portion of the special tabulation. Here is shown, for a total of 830 commercial and 586 municipal stations, the average capacity of dynamos per station and per machine, together with the value of plant and equipment per kilowatt capacity of dynamos.

For both steam plants and water-power plants a sufficiently large number of commercial stations are to be found under every grouping to enable reasonable conclusions to be drawn from the figures presented. Oil and gas plants are of significance only in the two lowest groups. In all classes, however, except in the case of steam plants, there are few municipal stations outside the lowest group. Municipal and commercial coal-using plants can, however, be compared as far as the fifth group, which reports a dynamo capacity of less than 5,000 kilowatts.

Table 95 COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—AVERAGE CAPACITY OF DYNAMOS PER STATION AND PER MACHINE, AND VALUE OF PLANT AND EQUIPMENT PER KILOWATT CAPACITY OF DYNAMOS, FOR GROUPS OF STATIONS SELECTED ACCORDING TO THE KIND OF PRIMARY POWER USED: 1917.

TOTAL KILOWATT CAPACITY OF DYNAMOS PER STATION.	Number of stations taken.		Average capacity of dynamos per station.		Average capacity of dynamos per machine.		Value of plant and equipment per kilowatt capacity of dynamos.	
	Commercial.	Municipal.	Commercial.	Municipal.	Commercial.	Municipal.	Commercial.	Municipal.
STEAM (COAL-USING) PLANTS.								
Under 200 kw.	138	173	100	94	62	65	$211	$182
200 *but under* 500 kw.	96	69	300	306	123	135	262	158
500 but under 1,000 kw.	31	20	696	637	211	190	390	158
1,000 but under 2,000 kw.	31	11	1,370	1,208	357	380	253	151
2,000 but under 5,000 kw.	26	8	3,120	3,132	670	716	253	137
5,000 but under 10,000 kw.	17	2	7,697	5,350	1,190	1,750	272	121
10,000 but under 20,000 kw.	11	2	14,807	13,200	2,172	3,300	333	188
20,000 but under 50,000 kw.	9	.....	30,890	.....	2,105	.....	240	.....
50,000 but under 100,000 kw.	3	.....	73,500	.....	8,820	.....	201	.....
100,000 kw. and over.	8	.....	198,918	.....	5,413	.....	295	.....
WATER-POWER PLANTS.[1]								
Under 200 kw.	105	30	87	98	60	89	360	262
200 but under 500 kw.	52	7	297	343	158	171	313	207
500 but under 1,000 kw.	20	9	687	607	292	287	273	210
1,000 but under 2,000 kw.	17	3	1,284	1,267	316	475	380	255
2,000 but under 5,000 kw.	13	.....	2,622	.....	631	.....	316	.....
5,000 but under 10,000 kw.	4	.....	7,975	.....	778	.....	259	.....
10,000 but under 20,000 kw.	6	.....	14,445	.....	1,354	.....	425	.....
20,000 but under 50,000 kw.	10	2	30,895	29,600	2,207	3,947	381	221
PLANTS USING ONLY OIL.[2]								
Under 200 kw.	189	232	42	40	27	27	302	257
200 but under 500 kw.	13	5	324	339	105	141	369	214
2,000 but under 5,000 kw.	5	.....	3,430	.....	686	.....	424	.....
10,000 but under 20,000 kw.	3	.....	16,200	.....	2,314	.....	330	.....
PLANTS USING ONLY GAS.[3]								
Under 200 kw.	14	9	110	92	70	55	158	139
200 but under 500 kw.	6	4	330	245	116	98	163	178
500 but under 1,000 kw.	3	.....	694	.....	160	.....	421	.....

[1] Exclusive of 2 commercial plants of the class "50,000 but under 100,000 kilowatts," *to avoid disclosure of individual operations*, and a single municipal plant of the class "2,000 but under 5,000 kilowatts."

[2] Exclusive of 2 commercial plants of the class "500 but under 1,000 kilowatts," 2 of the class "1,000 but under 2,000 kilowatts," and 1 of the class "5,000 but under 10,000 kilowatts," to avoid disclosure of individual operations, and all single municipal plants, including 1 of the class "2,000 but under 5,000 kilowatts," 1 of the class "5,000 but under 10,000 kilowatts," and 1 of the class "10,000 but under 20,000 kilowatts."

[3] Exclusive of 1 commercial plant of the class "1,000 but under 2,000 kilowatts" and 2 of the class "2,000 but under 5,000 kilowatts," to avoid disclosure of individual operations, and a single municipal plant of the class "500 but under 1,000 kilowatts."

1. *Steam plants.*—Municipal and commercial steam plants show the closest relation in investment in the lowest group, the former reporting an average of $182 per kilowatt capacity and the latter an average of $211. From this point the divergence is marked, municipal plants reporting a far lower cost per kilowatt than is found in the commercial stations. Various reasons for this lower investment have already been suggested in earlier chapters of the report. Perhaps, however, mention should again be made of the following facts: As the size of stations grows larger commercial plants are constantly serving a wider territory, which embraces numerous municipalities in addition to that in which the plant is located. This makes necessary a heavy investment in distribution lines, transformers, meters, etc., which increases the per capacity investment by an indeterminate amount. At any rate, it very frequently happens that investment in the distribution system is far in excess of that in the generating plant itself. Again, commercial stations, as the figures show, keep their equipment more nearly up to date than do municipal stations. This necessitates constant increase in investment. Further, it is also true that commercial stations are ordinarily disposed to keep a higher amount of reserve dynamo capacity than are the others. They also usually invest more in their buildings. Perhaps, also, in many cases they charge to capital account certain expenses of extension, renewal, or replacement which municipal plants may meet out of operating income, a practice which may make it possible for the time being to pay a high rate of dividends. Finally, a number of intangibles are no doubt included in the investment account of many commercial stations. Municipal plants, on the other hand, frequently do not carry on their books as investment that part of the value of plant and equipment the liability against which has been canceled by the liquidation of bonds originally issued to cover the cost of construction. Further, the value of real estate used by municipal plants is sometimes carried merely in the general accounts of a municipality, without being included in the value of the plant and equipment of the electric station. So far as intangibles are concerned, also, there is, of course, no opportunity to include such items in municipal plant investment. Other suggestions might be made, and as local conditions are not known it is possible that many of the figures for these selected but relatively small groups of municipal plants are not as representative as could be wished for. Beyond a doubt, however, the showing here made is a highly creditable one.

As coal-using plants increase in size, it does not appear from the figures in Table 95 that there is any marked tendency either to an increase or a decrease in the value of plant and equipment per kilowatt capacity of dynamos. To be sure, an abnormally high figure, $390, is found in the third group of commercial stations. This figure, however, results from abnormal conditions reported by one or two of the schedules included, and should be omitted in discussing the general data. With this omission, it is found that the second group shows a somewhat higher per capacity investment than does the first, and from this point until the group between 5,000 and 10,000 kilowatt capacity is reached there is little change. The next group reports an average of $333 per kilowatt, which again seems to be out of line with the figures on either side, and is probably due to the fact that the relatively few number of stations reporting do an extensive distribution business. From this point a rapid decrease is noted, to $240 and $201 in the two following groups. The group reporting "100,000 kilowatts and over" shows an increased investment, $295. This group comprises those central stations which distribute current in densely populated territories frequently serving scores of municipalities. On account of the difficulties of line construction

which they must encounter, as well as because of the many additional expenses in investment which they must undergo in order to keep the public satisfied, it is not surprising to find that the cost per kilowatt of such plants is higher. Municipal plants show no very marked trend in the matter of investment as the size is increased.

2. *Water-power plants.*—Both commercial and municipal water-power plants report a much higher investment per kilowatt capacity of dynamos than do the corresponding groups of coal-using stations. Here again, however, the figures are much lower for municipal plants; nor does it seem possible to draw any definite conclusion regarding the economies in investment as the size of plant increases. The investment per kilowatt in the 10 commercial water-power plants in the group having a capacity ranging from 20,000 to 50,000 kilowatts is $381, slightly higher than that of the 105 plants reported in the lowest group, $360.

3. *Oil-using and gas-using plants.*—Plants using only oil report a relatively high investment. In fact, there is little difference between the per kilowatt capacity value figures of this class of plants and the water-power plants. Gas-using plants, on the other hand, report the lowest investment of all, except for the class of "500 but under 1,000 kilowatts," which shows a value of $421 per kilowatt capacity. There are so few of these plants that the figures do not mean much.

Comparative value of plant and equipment of plant, grouped according to number of kilowatt hours generated.—Practically the same plants which were used in the tabulations summarized in Table 95 form the basis under a different classification for the figures which are presented in Table 96. Here, however, the classification is made on the basis of the number of kilowatt hours generated, and not only are operating and value data shown, but also the income and expenses per kilowatt hour sold. Similar figures are also presented for all commercial and municipal generating stations in the United States wherever it has been possible to secure these figures from the general tabulations.

First of all, attention should be called to the fact that in most groups under the different types of plants municipal stations report a larger number of kilowatt hours generated per kilowatt capacity of dynamos than do commercial stations. This, of course, may sometimes indicate that they have overestimated their output of current in cases where station meters are not used. However, in view of the fact that, as indicated by the figures which show the percentage disposal of current, municipal plants in the lower groups ordinarily do a relatively greater lighting business than commercial plants, it is probable that they are simply using their dynamos more nearly to the full extent of their capacity and are not maintaining so high a reserve equipment as are commercial stations. From the nature of their business it is perfectly evident that this higher output per kilowatt capacity is not the result of a better load factor or better diversity factor.

DIAGRAM 16.—INVESTMENT IN PLANT AND EQUIPMENT PER KILOWATT CAPACITY OF DYNAMOS, BY KIND OF PRIMARY POWER USED, FOR COMMERCIAL AND MUNICIPAL STATIONS: 1917.

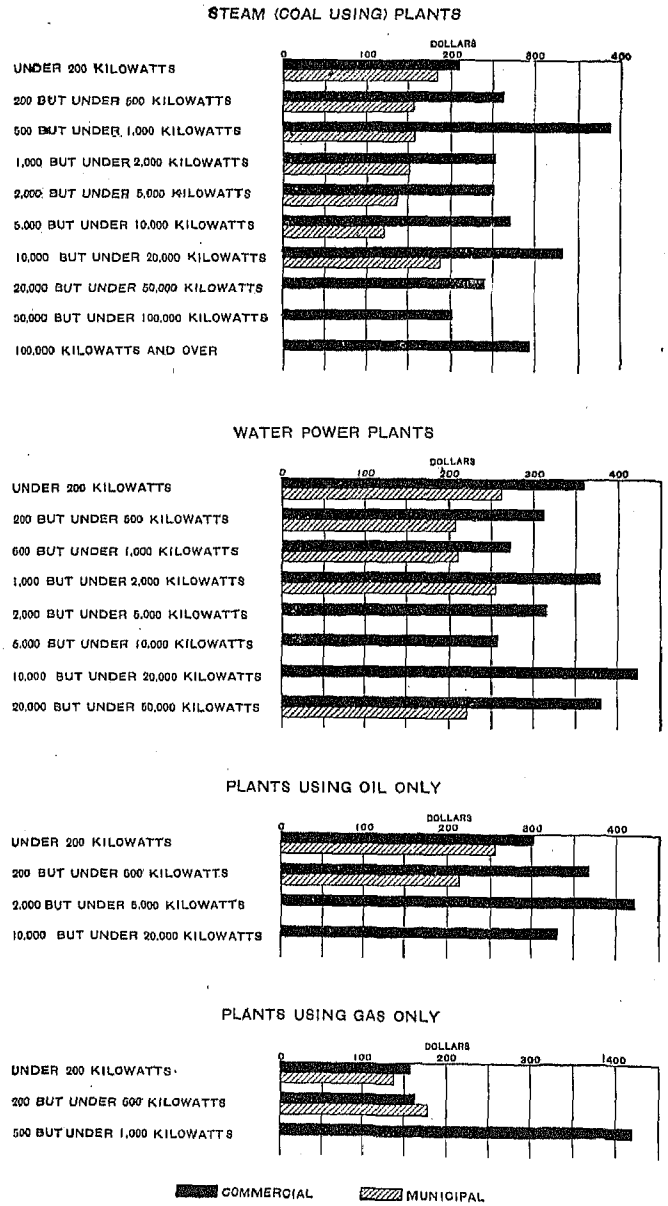


TABLE 96.—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—COMPARATIVE FINANCIAL AND OPERATING STATISTICS OF SELECTED GENERATING STATIONS, GROUPED ACCORDING TO THE NUMBER OF KILOWATT HOURS GENERATED AND THE TYPE OF PRIMARY POWER USED: 1917.

GROUP.	Number of stations.	Average dynamo capacity per station.	Kw. hours generated per kw. capacity of dynamos.	Average number of kw. hours generated per station.	PERCENTAGE DISPOSAL OF CURRENT.				INCOME PER KW. HOUR SOLD.						
					Light.	Power.	Other companies.	Losses in distribution, etc.	Total from all sources (1).	Total from sale of current.[1]	Light.[1]	Power.[1]	Other companies.	All other income.	Net income.
									Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
United States:															
Commercial	[2] 3,347	[2] 2,500	[2] 2,916	[2] 7,289,807	14.9	43.0	25.0	17.1	1.968	1.869	5.621	1.206	0.768	0.098	0.337
Municipal	[2] 1,777	[2] 324	[2] 1,807	[2] 584,873	54.2	27.7	1.7	16.4	3.911	3.852	4.030	1.864	1.547	0.059	0.910
STEAM (COAL-USING) PLANTS:[3]															
Under 200,000 kw. hours—															
Commercial	140	118	703	82,803	69.1	10.6	1.1	19.3	10.433	9.989	10.678	5.903	5.931	0.444	0.353
Municipal	168	101	810	82,101	75.1	6.3	1.2	17.4	9.947	9.722	10.081	6.346	5.000	0.224	0.925
200,000 but under 500,000 kw. hours—															
Commercial	66	288	1,108	318,465	55.0	22.8	3.6	18.6	7.828	7.377	8.811	4.288	5.000	0.451	0.426
Municipal	56	263	1,203	315,966	64.6	15.9	3.8	15.7	7.152	7.008	7.824	4.339	4.247	0.144	1.344
500,000 but under 1,000,000 kw. hours—															
Commercial	42	532	1,233	655,163	55.6	27.4	1.7	15.3	5.631	5.426	6.600	3.181	3.171	0.205	0.486
Municipal	26	416	1,597	664,659	54.5	25.3	1.1	19.1	5.477	5.392	6.319	3.511	2.763	0.086	0.920
1,000,000 but under 2,000,000 kw. hours—															
Commercial	25	860	1,560	1,342,497	46.3	27.6	5.5	20.6	5.707	5.458	7.473	2.498	3.338	0.250	0.794
Municipal	16	795	1,621	1,288,444	50.2	28.6	1.4	19.8	5.447	5.381	6.502	3.584	1.844	0.066	1.601
2,000,000 but under 5,000,000 kw. hours—															
Commercial	30	1,718	1,822	3,130,069	28.5	41.4	13.6	16.5	4.081	3.903	7.036	2.352	2.004	0.177	0.543
Municipal	11	1,663	2,141	3,560,131	46.6	31.7	3.7	18.0	3.350	3.305	4.500	1.766	1.459	0.045	0.850
5,000,000 but under 10,000,000 kw. hours—															
Commercial	19	4,166	1,685	7,021,922	24.7	42.0	13.9	19.4	3.876	3.755	7.461	2.297	1.567	0.122	0.438
Municipal	5	4,310	1,818	7,836,940	45.2	32.4	2.3	20.1	3.260	3.191	4.186	1.939	1.306	0.068	0.658
10,000,000 but under 20,000,000 kw. hours—															
Commercial	11	5,949	2,183	12,986,584	18.0	46.9	17.9	17.2	2.656	2.553	6.430	1.675	0.958	0.103	0.490
20,000,000 but under 50,000,000 kw. hours—															
Commercial	15	12,986	2.120	27,537,040	19.8	42.6	21.8	15.9	2.593	2.534	5.193	1.832	1.493	0.059	0.420
50,000,000 but under 100,000,000 kw. hours—															
Commercial	8	29,858	2,482	74,115,002	19.1	43.7	20.2	17.0	2.442	2.297	4.612	1.877	1.017	0.144	0.487
100,000,000 but under 200,000,000 kw. hours—															
Commercial	4	46,260	2,768	128,058,872	18.4	44.0	24.8	12.8	1.680	1.627	4.036	1.163	0.664	0.053	0.294
200,000,000 kw. hours and over—															
Commercial	9	186,260	3,120	581,210,537	26.9	31.6	24.9	16.5	2.501	2.487	4.939	1.565	1.006	0.104	0.553
WATER-POWER PLANTS:[4]															
Under 200,000 kw. hours—															
Commercial	116	123	579	71,485	66.2	16.4	2.3	15.1	8.271	7.931	8.908	4.560	3.825	0.340	1.103
Municipal	25	90	748	67,539	75.8	5.6	1.3	17.3	7.979	7.800	8.160	4.560	0.822	0.179	2.297
200,000 but under 500,000 kw. hours—															
Commercial	38	306	947	289,408	50.7	23.3	7.4	18.6	5.384	5.156	6.856	2.452	2.008	0.228	0.911
Municipal	11	268	1,260	337,448	63.8	20.2	.....	16.0	4.196	4.093	4.447	2.976	.....	0.102	1.604
500,000 but under 1,000,000 kw. hours—															
Commercial	16	475	1,518	720,479	44.2	20.6	17.2	18.0	3.570	3.435	4.762	2.378	1.287	0.135	0.874
Municipal	5	568	1,356	770,394	44.3	30.1	7.6	18.0	2.667	2.644	3.880	1.054	1.729	0.022	0.890
1,000,000 but under 2,000,000 kw. hours—															
Commercial	11	1,059	1,344	1,422,625	23.1	55.4	4.6	16.9	3.131	2.994	6.846	1.488	1.807	0.137	0.777
Municipal	6	925	1,317	1,218,660	37.0	40.4	4.7	17.8	2.602	2.545	3.918	1.378	1.769	0.058	1.000
2,000,000 but under 5,000,000 kw. hours—															
Commercial	16	1,802	1,708	3,077,245	12.9	37.8	32.5	16.8	1.994	1.928	5.719	1.354	1.088	0.067	0.243
Municipal	2	725	4,171	3,024,329	59.7	25.3	.....	15.0	2.007	1.988	2.360	1.110	.....	0.019	0.940
5,000,000 but under 10,000,000 kw. hours—															
Commercial	11	3,014	2,269	6,840,098	10.6	62.5	11.7	15.2	1.719	1.647	5.753	1.127	0.692	0.072	0.418
20,000,000 but under 50,000,000 kw. hours—															
Commercial	4	10,708	3,650	39,087,441	3.6	57.4	25.0	14.0	1.100	1.067	6.700	0.965	0.493	0.033	0.257
50,000,000 but under 100,000,000 kw. hours—															
Commercial	8	19,439	3,622	70,404,045	1.4	42.9	41.4	14.4	0.826	0.793	3.704	0.942	0.544	0.033	0.117
100,000,000 but under 200,000,000 kw. hours—															
Commercial	6	36,243	4,065	147,335,110	5.4	56.7	22.1	15.8	0.774	0.746	2.923	0.634	0.502	0.028	0.219
OIL-USING PLANTS:[5]															
Under 200,000 kw. hours—															
Commercial	190	47	763	35,522	71.5	13.0	0.4	15.1	11.768	11.348	12.394	5.717	7.300	0.420	0.480
Municipal	230	39	740	29,133	77.7	4.0	0.7	17.6	12.129	11.915	12.332	4.889	6.255	0.214	0.520
200,000 but under 500,000 kw. hours—															
Commercial	7	240	1,168	280,059	60.6	17.8	3.8	17.8	7.927	7.399	8.254	4.314	8.190	0.528	1.153
Municipal	5	276	1,203	332,549	50.3	22.5	.....	27.2	7.151	6.657	7.640	4.471	.....	0.494	2.079
500,000 but under 1,000,000 kw. hours—															
Commercial	4	294	2,250	660,912	51.3	32.5	.....	16.2	4.497	4.257	5.032	3.032	.....	0.240	0.598
2,000,000 but under 5,000,000 kw. hours—															
Commercial	4	1,710	1,874	3,204,172	34.6	35.8	14.9	14.7	4.871	4.482	7.265	2.950	1.683	0.389	1.445
5,000,000 but under 10,000,000 kw. hours—															
Commercial	3	3,217	2,225	7,157,782	25.9	28.3	18.7	27.1	4.860	4.640	8.394	3.251	1.536	0.219	1.218
20,000,000 but under 50,000,000 kw. hours—															
Commercial	3	13,733	2,590	35,575,411	31.6	38.6	8.4	21.4	3.196	3.102	4.723	2.018	1.986	0.094	0.870
GAS-USING PLANTS:															
Under 200,000 kw. hours—															
Commercial	14	121	838	101,344	67.5	15.9	.....	16.6	7.596	7.507	8.516	3.237	.....	0.089	0.636
Municipal	8	81	826	67,010	84.0	0.6	.....	15.4	6.768	6.680	6.705	3.429	.....	0.088	1.073
200,000 but under 500,000 kw. hours—															
Commercial	6	305	1,146	349,219	48.9	26.7	.....	24.4	6.517	6.132	8.196	2.340	.....	0.386	0.953
Municipal	4	215	1,691	363,583	64.6	21.9	.....	13.5	5.782	5.782	5.134	2.563	.....	.....	2.016
500,000 but under 1,000,000 kw. hours—															
Municipal	2	440	1,403	617,288	39.5	52.7	.....	7.8	5.364	5.336	8.670	2.843	.....	0.028	1.654
1,000,000 but under 2,000,000 kw. hours—															
Commercial	3	2,098	648	1,359,005	45.2	32.3	1.6	20.9	4.014	3.792	4.880	2.399	1.307	0.222	0.575
2,000,000 but under 5,000,000 kw. hours—															
Commercial	3	2,156	1,308	2,820,116	33.8	39.0	15.2	12.0	2.625	2.490	4.060	1.554	1.360	0.135	0.655

(See footnotes at end of table.)

TABLE 96.—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—COMPARATIVE FINANCIAL AND OPERATING STATISTICS OF SELECTED GENERATING STATIONS, GROUPED ACCORDING TO THE NUMBER OF KILOWATT HOURS GENERATED AND THE TYPE OF PRIMARY POWER USED: 1917—Continued.

GROUP.	EXPENSES.														
	Total per kw. hour sold.	Supplies and materials per kw. hour sold.	Salaries and wages.		Fuel.			Miscellaneous expenses per kw. hour sold.	Insurance per kw. hour sold.	Taxes.			Depreciation.		
			Per kw. hour sold.	Per cent of total expenses.	Per kw. hour generated.	Per kw. hour sold.	Per cent of total expenses.			Per kw. hour sold.	Per cent of total expenses.	Per cent of investment.	Per kw. hour sold.	Per cent of total expenses.	Per cent of investment.
	Cents.	*Cents.*	*Cents.*		*Cents.*	*Cents.*		*Cents.*	*Cents.*	*Cents.*			*Cents.*		
United States:															
Commercial	1.581	0.090	0.350	22.1	[6] 0.470	(7)	[2] 21.2	0.296	0.014	0.121	7.6	1.0	0.106	6.6	0.9
Municipal	3.001	0.400	0.852	28.3	[6] 1.100	(7)	[2] 34.7	0.401	0.026	0.016	0.5	0.1	0.196	6.4	1.6
STEAM (COAL-USING) PLANTS: [3]															
Under 200,000 kw. hours—															
Commercial	10.080	0.967	3.285	32.6	3.103	3.836	38.1	0.533	0.152	0.298	3.0	0.9	0.521	5.2	1.6
Municipal	9.022	1.193	2.816	31.2	3.292	3.983	44.1	0.245	0.108	0.005	(8)	(8)	0.087	1.0	0.3
200,000 but under 500,000 kw. hours—															
Commercial	7.401	0.554	2.148	29.0	2.286	2.809	38.0	0.532	0.155	0.251	3.4	1.0	0.335	4.5	1.3
Municipal	5.807	0.751	1.570	27.0	2.320	2.752	47.4	0.245	0.066	0.001	(8)	(8)	0.137	2.4	0.9
500,000 but under 1,000,000 kw. hours—															
Commercial	5.145	0.392	1.409	27.4	1.476	1.732	33.7	0.523	0.082	0.204	4.0	0.7	0.339	6.6	1.2
Municipal	4.557	0.630	1.324	29.1	1.612	1.990	43.7	0.195	0.059	0.007	0.2	(8)	0.171	3.7	1.4
1,000,000 but under 2,000,000 kw. hours—															
Commercial	4.913	0.341	1.289	26.2	1.297	1.632	33.2	0.349	0.076	0.211	4.3	0.8	0.450	9.2	1.8
Municipal	3.846	0.457	1.133	29.4	1.246	1.555	40.4	0.154	0.057	0.002	0.1	(8)	0.296	7.7	2.5
2,000,000 but under 5,000,000 kw. hours—															
Commercial	3.535	0.297	0.833	23.6	1.027	1.226	34.6	0.249	0.052	0.178	5.0	1.1	0.273	7.7	1.7
Municipal	2.500	0.327	0.629	25.2	0.891	1.087	43.5	0.090	0.037	0.017	0.7	0.2	0.256	10.2	3.1
5,000,000 but under 10,000,000 kw. hours—															
Commercial	3.438	0.218	0.797	23.2	0.900	1.107	32.2	0.287	0.046	0.186	5.4	1.0	0.367	10.7	2.0
Municipal	2.601	0.245	0.671	25.8	0.784	0.981	37.7	0.057	0.021	0.050	1.9	0.5	0.410	15.7	4.4
10,000,000 but under 20,000,000 kw. hours—															
Commercial	2.166	0.109	0.481	22.2	0.609	0.722	33.3	0.258	0.014	0.153	7.1	1.0	0.117	5.4	0.8
20,000,000 but under 50,000,000 kw. hours—															
Commercial	2.173	0.106	0.486	22.3	0.602	0.708	32.6	0.243	0.021	0.170	7.8	1.2	0.154	7.1	1.1
50,000,000 but under 100,000,000 kw. hours—															
Commercial	1.955	0.131	0.443	22.6	0.520	0.613	31.4	0.125	0.011	0.137	7.0	1.1	0.196	10.1	1.6
100,000,000 but under 200,000,000 kw. hours—															
Commercial	1.387	0.048	0.288	20.7	0.441	0.489	35.3	0.152	0.012	0.090	6.5	0.9	0.106	7.7	1.1
200,000,000 kw. hours and over—															
Commercial	2.038	0.130	0.494	24.2	0.462	0.541	26.5	0.292	0.021	0.204	10.0	1.9	0.133	6.5	1.2
WATER-POWER PLANTS: [4]															
Under 200,000 kw. hours—															
Commercial	7.168	0.963	3.117	43.5	.....	0.072	.....	0.690	0.103	0.402	5.6	0.8	0.776	10.8	1.5
Municipal	5.682	1.164	2.476	43.6	.....	0.021	.....	0.310	0.046	.....	.....	.....	0.277	4.9	0.7
200,000 but under 500,000 kw. hours—															
Commercial	4.472	0.631	1.657	37.0	.....	.....	.....	0.473	0.080	0.316	7.1	0.7	0.423	9.5	0.9
Municipal	2.592	0.398	1.225	47.3	.....	.....	.....	0.234	0.032	0.049	1.9	0.2	0.070	2.7	0.3
500,000 but under 1,000,000 kw. hours—															
Commercial	2.697	0.333	0.921	34.2	.....	.....	.....	0.241	0.042	0.156	5.8	0.6	0.258	9.6	1.0
Municipal	1.777	0.256	0.764	43.0	.....	.....	.....	0.115	0.030	0.022	1.2	0.1	0.141	7.9	0.9
1,000,000 but under 2,000,000 kw. hours—															
Commercial	2.354	0.215	0.823	35.0	.....	.....	.....	0.290	0.055	0.152	6.5	0.5	0.266	11.3	0.9
Municipal	1.602	0.290	0.547	34.1	.....	.....	.....	0.232	0.015	0.024	1.5	0.2	0.155	9.7	1.2
2,000,000 but under 5,000,000 kw. hours—															
Commercial	1.751	0.088	0.476	27.2	.....	.....	.....	0.195	0.026	0.123	7.0	0.6	0.228	13.0	1.0
Municipal	1.067	0.318	0.382	35.8	.....	.....	.....	0.100	0.011	.....	.....	.....	.....	.....	.....
5,000,000 but under 10,000,000 kw. hours—															
Commercial	1.301	0.085	0.354	27.2	.....	.....	.....	0.204	0.018	0.104	8.0	0.7	0.199	15.3	1.4
20,000,000 but under 50,000,000 kw. hours—															
Commercial	0.843	0.047	0.181	21.5	.....	0.012	.....	0.153	0.006	0.074	8.8	0.7	0.078	9.2	0.7
50,000,000 but under 100,000,000 kw. hours—															
Commercial	0.709	0.034	0.135	19.1	.....	0.009	.....	0.082	0.006	0.054	7.6	0.5	0.070	9.9	0.6
100,000,000 but under 200,000,000 kw. hours—															
Commercial	0.555	0.038	0.124	22.4	.....	0.034	.....	0.055	0.005	0.064	11.5	0.6	0.029	5.3	3.3
OIL-USING PLANTS: [5]															
Under 200,000 kw. hours—															
Commercial	11.281	1.208	3.974	35.2	3.026	3.565	31.6	0.646	0.164	0.331	2.9	0.8	0.621	5.5	1.5
Municipal	11.609	1.207	4.370	37.6	3.209	3.895	33.6	0.309	0.113	0.002	.....	.....	0.183	1.6	0.4
200,000 but under 500,000 kw. hours—															
Commercial	6.774	0.797	1.621	23.9	1.480	1.798	26.6	0.404	0.105	0.270	4.0	0.8	0.893	13.2	2.7
Municipal	5.072	0.770	1.741	34.3	0.877	1.206	23.8	0.694	0.103	.....	.....	.....	.....	.....	.....
500,000 but under 1,000,000 kw. hours—															
Commercial	3.899	0.501	1.047	26.9	1.001	1.192	30.6	0.222	0.065	0.159	4.1	1.2	0.354	9.1	2.7
2,000,000 but under 5,000,000 kw. hours—															
Commercial	3.426	0.241	0.862	25.2	1.124	1.318	38.5	0.330	0.040	0.085	2.5	0.6	0.184	5.4	1.2
5,000,000 but under 10,000,000 kw. hours—															
Commercial	3.641	0.152	0.769	21.1	0.520	0.714	19.6	0.515	0.034	0.270	7.4	0.7	0.355	9.7	0.9
20,000,000 but under 50,000,000 kw. hours—															
Commercial	2.326	0.129	0.586	25.2	0.293	0.363	15.6	0.199	0.015	0.375	16.1	2.6	0.270	11.6	1.9
GAS-USING PLANTS:															
Under 200,000 kw. hours—															
Commercial	6.960	0.943	3.053	43.9	1.055	1.265	18.2	0.759	0.055	0.297	4.3	1.7	0.140	2.0	0.8
Municipal	5.695	1.233	2.048	36.0	0.855	1.010	17.7	0.254	0.026	.....	.....	.....	0.468	8.2	2.6
200,000 but under 500,000 kw. hours—															
Commercial	5.564	0.569	1.887	33.9	0.689	0.912	16.4	0.551	0.096	0.347	6.2	1.5	0.312	5.6	1.4
Municipal	3.766	1.260	1.205	32.0	0.648	0.749	19.9	0.125	0.024	0.012	0.3	0.1	.....	.....	.....
500,000 but under 1,000,000 kw. hours—															
Municipal	3.710	0.996	1.000	27.0	1.010	1.095	29.5	0.080	0.010	.....	.....	.....	0.239	6.5	2.0
1,000,000 but under 2,000,000 kw. hours—															
Commercial	3.439	0.569	0.791	23.0	0.478	0.594	17.3	0.461	0.036	0.255	7.4	1.2	0.135	3.9	0.6
2,000,000 but under 5,000,000 kw. hours—															
Commercial	1.970	0.205	0.576	29.3	0.410	0.466	23.6	0.127	0.042	0.118	6.0	1.5	0.113	5.7	1.4

(See footnotes at end of table.)

TABLE 96.—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—COMPARATIVE FINANCIAL AND OPERATING STATISTICS OF SELECTED GENERATING STATIONS, GROUPED ACCORDING TO THE NUMBER OF KILOWATT HOURS GENERATED AND THE TYPE OF PRIMARY POWER USED: 1917—Continued.

GROUP.	EXPENSES—continued. Interest. Per kw. hour sold.	EXPENSES—continued. Interest. Per cent of total expenses.	DIVIDENDS. Per kw. hour sold.	DIVIDENDS. Per cent of investment.	VALUE OF PLANT AND EQUIPMENT. Per kw. hour sold.	VALUE OF PLANT AND EQUIPMENT. Per kw. capacity of dynamos.	VALUE OF PLANT AND EQUIPMENT. Total income—Per cent of investment.	EMPLOYEES. Number per station.	EMPLOYEES. Average compensation.	EMPLOYEES. Kw. hours sold per employee.	EMPLOYEES. Total income per employee.	FUEL—COAL. Price per ton.	FUEL—COAL. Pounds per kw. hour generated.
United States:	*Cents.*		*Cents.*		*Cents.*	*Dollars.*			*Dollars.*		*Dollars.*	*Dollars.*	
Commercial	0.288	18.2	0.261	2.2	11.9	[2] 339	[2] 16.6	22.4	913	261,119	5,140	[7]	[7]
Municipal	0.237	7.9	.....	.....	12.4	[2] 180	[2] 31.6	4.7	807	94,775	3,706	[7]	[7]
STEAM (COAL-USING) PLANTS:[3]													
Under 200,000 kw. hours—													
Commercial	0.489	4.9	0.250	0.8	31.5	179	33.2	3.1	713	21,712	2,265	3.40	18.26
Municipal	0.585	6.5	.....	.....	25.4	170	39.2	2.5	750	26,636	2,649	[9] 3.78	[10] 17.51
200,000 but under 500,000 kw. hours—													
Commercial	0.617	8.3	0.230	0.9	26.2	236	29.9	6.3	879	40,912	3,203	3.87	11.88
Municipal	0.284	4.9	.....	.....	15.4	156	46.4	5.2	797	50,738	3,628	3.74	12.45
500,000 but under 1,000,000 kw. hours—													
Commercial	0.462	9.0	0.397	1.4	28.8	303	19.5	9.5	830	58,893	3,316	[9] 3.39	8.71
Municipal	0.181	4.0	.....	.....	12.2	158	44.8	8.1	878	66,324	3,033	3.08	8.94
1,000,000 but under 2,000,000 kw. hours—													
Commercial	0.564	11.5	0.508	2.0	25.1	312	22.7	16.3	843	65,426	3,734	3.59	7.32
Municipal	0.192	5.0	.....	.....	11.9	154	45.9	13.0	904	79,814	4,348	[11] 4.24	[12] 5.90
2,000,000 but under 5,000,000 kw. hours—													
Commercial	0.427	12.1	0.369	2.3	16.0	244	25.5	24.8	883	105,889	4,322	3.57	5.78
Municipal	0.057	2.3	.....	.....	8.2	144	40.7	20.8	882	140,192	4,697	3.06	5.82
5,000,000 but under 10,000,000 kw. hours—													
Commercial	0.430	12.5	0.343	1.9	18.0	247	21.5	51.1	890	111,673	4,329	[9] 4.16	[13] 4.35
Municipal	0.166	6.4	.....	.....	9.3	136	34.9	44.2	951	141,718	4,619	4.08	3.84
10,000,000 but under 20,000,000 kw. hours—													
Commercial	0.312	14.4	0.329	2.2	14.8	268	18.0	59.1	880	182,877	4,858	[14] 4.16	[15] 2.95
20,000,000 but under 50,000,000 kw. hours—													
Commercial	0.284	13.1	0.357	2.5	14.5	261	17.9	126.9	898	184,622	4,789	3.61	3.34
50,000,000 but under 100,000,000 kw. hours—													
Commercial	0.298	15.2	0.384	3.1	12.3	259	19.8	302.8	919	207,687	5,071	3.25	3.32
100,000,000 but under 200,000,000 kw. hours—													
Commercial	0.201	14.5	0.301	3.1	9.9	246	17.0	315.0	1,053	366,289	6,157	3.60	2.55
200,000,000 kw. hours and over—													
Commercial	0.223	11.0	0.420	3.8	11.0	293	23.6	2,446.5	1,002	202,755	5,254	3.71	[16] 2.49
WATER-POWER PLANTS:													
Under 200,000 kw. hours—													
Commercial	1.042	14.5	0.195	0.4	52.8	259	15.7	2.7	713	22,861	1,891	.....	.....
Municipal	1.387	24.4	.....	.....	41.1	254	19.4	2.1	664	26,839	2,141	.....	.....
200,000 but under 500,000 kw. hours—													
Commercial	0.891	19.9	0.430	1.0	44.9	347	12.0	5.2	759	45,771	2,464	.....	.....
Municipal	0.582	22.4	.....	.....	22.4	237	18.7	5.0	696	56,778	2,382	.....	.....
500,000 but under 1,000,000 kw. hours—													
Commercial	0.745	27.6	0.473	1.8	26.8	334	13.3	6.4	853	92,632	3,308	.....	.....
Municipal	0.447	25.2	.....	.....	16.1	181	16.5	6.0	810	105,069	2,828	.....	.....
1,000,000 but under 2,000,000 kw. hours—													
Commercial	0.533	22.6	0.392	1.3	29.2	330	10.7	10.2	968	117,563	3,682	.....	.....
Municipal	0.340	21.2	.....	.....	13.4	146	19.4	6.5	847	154,917	4,032	.....	.....
2,000,000 but under 5,000,000 kw. hours—													
Commercial	0.564	32.2	0.164	0.7	22.1	320	9.0	13.8	900	188,939	3,768	.....	.....
Municipal	0.256	24.0	.....	.....	6.2	222	3.3	13.5	733	191,955	3,853	.....	.....
5,000,000 but under 10,000,000 kw. hours—													
Commercial	0.335	25.7	0.237	1.6	14.5	279	11.8	23.5	878	247,608	4,257	.....	.....
20,000,000 but under 50,000,000 kw. hours—													
Commercial	0.293	34.7	0.079	0.8	10.4	337	10.6	57.5	1,092	602,957	6,635	.....	.....
50,000,000 but under 100,000,000 kw. hours—													
Commercial	0.318	44.9	0.110	1.0	11.5	365	7.2	77.4	1,080	797,572	6,591	.....	.....
100,000,000 but under 200,000,000 kw. hours—													
Commercial	0.207	37.3	0.063	0.6	11.4	393	6.8	166.8	928	745,842	5,777	.....	.....

GROUP.	FUEL—OIL. Price per barrel.	FUEL—OIL. Gallons per kw. hour generated.[17]
OIL-USING PLANTS:[5]	*Dollars.*	
Under 200,000 kw. hours—		
Commercial	3.49	0.43
Municipal	4.02	0.40
200,000 but under 500,000 kw. hours—		
Commercial	1.52	0.49
Municipal	[18]	[18]
500,000 but under 1,000,000 kw. hours—		
Commercial	1.74	0.20
2,000,000 but under 5,000,000 kw. hours—		
Commercial	1.01	0.55
5,000,000 but under 10,000,000 kw. hours—		
Commercial	0.82	0.32
20,000,000 but under 50,000,000 kw. hours—		
Commercial	0.77	0.19

GROUP.	EMPLOYEES. Number per station.	EMPLOYEES. Average compensation.	EMPLOYEES. Kw. hours sold per employee.	EMPLOYEES. Total income per employee.
OIL-USING PLANTS:[5]				
Under 200,000 kw. hours—				
Commercial	1.9	641	16,137	1,899
Municipal	1.5	708	16,190	1,964
200,000 but under 500,000 kw. hours—				
Commercial	4.0	934	57,616	4,567
Municipal	5.2	810	46,538	3,328
500,000 but under 1,000,000 kw. hours—				
Commercial	5.8	1,009	96,378	4,334
2,000,000 but under 5,000,000 kw. hours—				
Commercial	29.0	813	94,247	4,591
5,000,000 but under 10,000,000 kw. hours—				
Commercial	46.3	866	112,590	5,472
20,000,000 but under 50,000,000 kw. hours—				
Commercial	168.0	1,003	171,140	5,470

(See footnotes at end of table.)

TABLE 96.—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—COMPARATIVE FINANCIAL AND OPERATING STATISTICS OF SELECTED GENERATING STATIONS, GROUPED ACCORDING TO THE NUMBER OF KILOWATT HOURS GENERATED AND THE TYPE OF PRIMARY POWER USED: 1917—Continued.

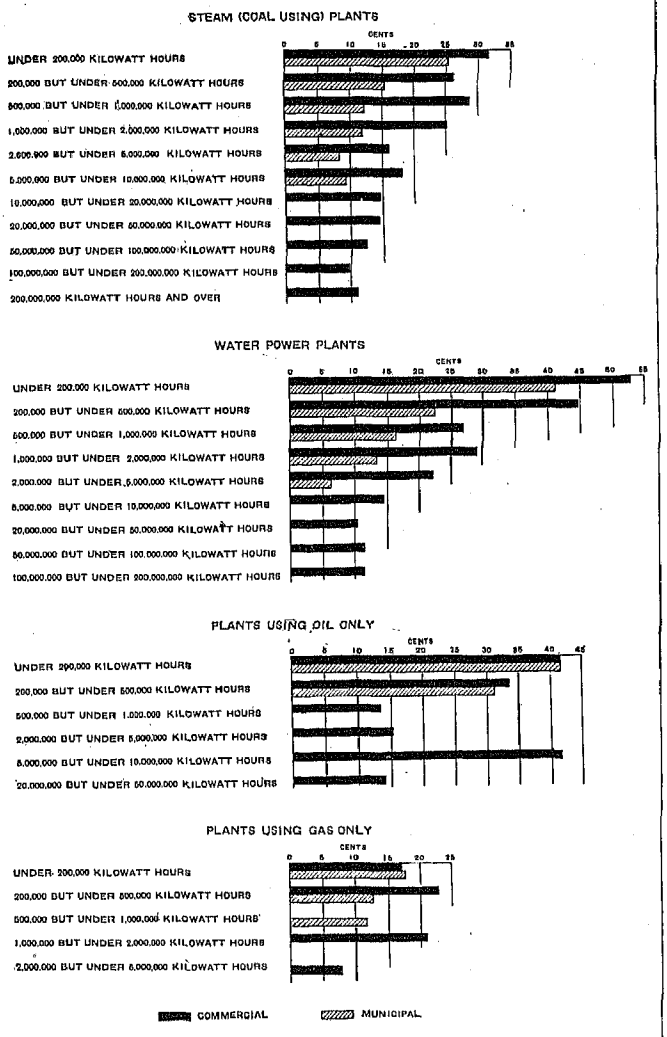
GROUP.	EXPENSES—continued.		DIVIDENDS.		VALUE OF PLANT AND EQUIPMENT.			EMPLOYEES.				FUEL—GAS.	
	Interest.												
	Per kw. hour sold.	Per cent of total expenses.	Per kw. hour sold.	Per cent of investment.	Per kw. hour sold.	Per kw. capacity of dynamos.	Total income—Per cent of investment.	Number per station.	Average compensation.	Kw. hours sold per employee.	Total income per employee.	Price per 1,000 cu. ft.	Cu. ft. per kw. hour generated.
GAS-USING PLANTS:													
Under 200,000 kw. hours—	*Cents.*		*Cents.*		*Cents.*	*Dollars.*			*Dollars.*		*Dollars.*	*Cents.*	
Commercial	0.448	6.4	0.068	0.4	17.2	120	44.2	3.2	804	26,321	1,999	16.3	64.8
Municipal	0.655	11.5	.....	.....	17.8	124	38.0	1.6	715	34,904	2,362	14.5	59.2
200,000 but under 500,000 kw. hours—													
Commercial	0.890	16.0	0.316	1.4	22.8	198	28.6	6.3	787	41,686	2,717	15.2	45.5
Municipal	0.392	10.4	.....	.....	12.6	185	45.8	4.5	842	69,895	4,041	11.5	56.1
500,000 but under 1,000,000 kw. hours—													
Municipal	0.290	7.8	.....	.....	11.8	153	45.3	7.0	814	81,299	4,361	30.6	33.0
1,000,000 but under 2,000,000 kw. hours—													
Commercial	0.597	17.4	0.120	0.6	21.0	109	19.1	10.0	895	113,173	4,543	11.7	41.0
2,000,000 but under 5,000,000 kw. hours—													
Commercial	0.322	16.4	0.050	0.6	7.9	91	33.2	17.0	825	143,131	3,757	33.2	12.3

[1] Estimated value of free service included.
[2] *Includes only those stations which generated all or part of current.*
[3] Exclusive of all single municipal stations, including 1 of the group "10,000,000 but under 20,000,000 kw. hours," 1 of the group "20,000,000 but under 50,000,000 kw. hours," and of the group "50,000,000 but under 100,000,000 kw. hours."
[4] Exclusive of 1 commercial station of the group "10,000,000 but under 20,000,000 kw. hours," and 2 of the group "200,000,000 kw. hours, and over," to avoid disclosure of individual operations; and all single municipal stations, including 1 of the group "5,000,000 but under 10,000,000 kw. hours," 1 of the group "50,000,000 but under 100,000,000 kw. hours," and 1 of the group "100,000,000 but under 200,000,000 kw. hours."
[5] Exclusive of 2 commercial stations of the group "1,000,000 but under 2,000,000 kw. hours," 1 of the group "10,000,000 but under 20,000,000 kw. hours," and 1 of the group "50,000,000 but under 100,000,000 kw. hours," to avoid disclosure of individual operations; and all single municipal stations, including 1 of the group "500,000 but 1,000,000 kw. hours," 1 of the group "1,000,000 but under 2,000,000 kw. hours," 1 of the group "2,000,000 but under 5,000,000 kw. hours," 1 of the group "5,000,000 but under 10,000,000 kw. hours," and 1 of the group "10,000,000 but under 20,000,000 kw. hours."
[6] Estimated on the basis of the percentage of dynamos not driven by water power.
[7] Unknown.
[8] Less than one-tenth of 1 per cent.
[9] Includes the price of a relatively small amount of gas.
[10] This group also used 2 cubic feet of gas per kw. hour.
[11] Includes the price of a considerable quantity of gas.
[12] This group also used 8.7 cubic feet of gas per kw. hour.
[13] This group also used 1.6 cubic feet of gas per kw. hour.
[14] Includes the price of some gas.
[15] This group also used 2.5 cubic feet of gas per kw. hour.
[16] A relatively negligible quantity of gas was also used.
[17] Computed on basis of 50 gallons per barrel.
[18] Accurate figures not available.

So far as the investment per kilowatt capacity of dynamos is concerned, no more need be said, as data for this item have been presented in connection with Table 95. It may, however, be interesting to call attention to the amount of investment per kilowatt hour sold (Table 96). Here again we find that in most cases each kilowatt hour sold requires a fewer number of cents investment for municipal than for commercial stations. For each type of plant there is little difference in the lowest group, particularly for the oil and gas plants. In other groups, however, the difference is marked. As the size of plant increases there is to be found a constant decrease in the number of cents invested per kilowatt hour sold for both steam and water-power plants. In other types of plants the tendency is not clear.

A further analysis can be made of the per cent which the total income forms of the value of plant and equipment in these classified plants. Again, it appears that in most cases the income bears a higher ratio to the value for municipal than for commercial plants. All plants considered, however, there does not appear to be any close relation between the size of station and the percentage relation of income and investment so far as the low groups are concerned. As the groups of commercial plants grow larger it is found that the investment grows increasingly higher in relation to the total income. This is particularly true of water-power plants, in which the ratio of income to investment decreases from 15.7 per cent in the lowest group to 6.8 per cent in the highest; in other words, the total income of the largest hydroelectric plants is a little more than one-sixteenth the investment. Hence, with the heavy fixed charges which must be incurred, a slight decrease in income may mean the financial ruin of such a plant. The significance of this condition will become increasingly evident as other figures in the table are studied.

DIAGRAM 17.—INVESTMENT IN PLANT AND EQUIPMENT PER KILOWATT HOUR SOLD, BY KIND OF PRIMARY POWER USED, FOR COMMERCIAL AND MUNICIPAL STATIONS: 1917 (CENTS).



Expenses per kilowatt hour sold.—The total expenses per kilowatt hour sold, as shown in Table 96, while only about one-half as high (1.581 cents) for all commercial plants in the United States as for all municipal plants (3.001 cents), are usually somewhat lower in the groups of municipal stations included in Table 96 than for the corresponding commercial stations. For commercial steam plants, however, there is a constant and marked decrease in cost per kilowatt hour, as plants increase in size, from 10.080 cents in the lowest group to 1.387 cents in next to the highest group. Commercial water-power plants show a cost which decreases from 7.168 cents in the lowest group to little more than one-half of 1 cent in the highest group. Similar conditions are to be found in the case of the few oil and gas using plants reported.

Some attention should perhaps be given to the various items which enter into the expenses of operation. It should first be mentioned in passing that the questionable sinking-fund charges have been omitted from this tabulation. The items of expense of most interest for comparative purposes are supplies and materials, salaries and wages, fuel, taxes, depreciation, and interest. Other items, with the exception of insurance, have been grouped under the head of "Miscellaneous."

The expenditure for supplies and materials, not including fuel and wages, is difficult to reduce to any standard. For all municipal plants in the United States, however, the amount paid under this head per kilowatt hour sold is four-tenths of 1 cent, while the corresponding payment by commercial plants is only nine one-hundredths of 1 cent. Consequently it is not surprising to find that in every group of coal-using stations municipal plants report a higher unit expenditure for this purpose than do commercial stations.

There appears to be no necessary connection between the price per ton paid for coal and the size of stations. It is, of course, posssible that the larger stations are securing a better quality of coal for their money, and it is further true that many of the small coal-using plants are situated in districts where coal is very cheap. Nor does it appear that there is any marked difference between the price paid by municipal and by commercial plants. In three cases the rates are higher for municipal stations, in two cases they are somewhat lower, and in one case noticeably lower. Further, there seems to be little difference between the two groups so far as concerns the number of pounds of coal used per kilowatt hour generated. The interesting fact, however, is the uninterrupted decrease in the number of pounds of coal required as commercial plants increased in size, the highest group requiring only 2.49 pounds per kilowatt hour, while the lowest uses 18.26 pounds.

DIAGRAM 18.—PER CENT WHICH TOTAL INCOME FORMS OF INVESTMENT IN COMMERCIAL AND MUNICIPAL STEAM AND WATER POWER PLANTS: 1917.

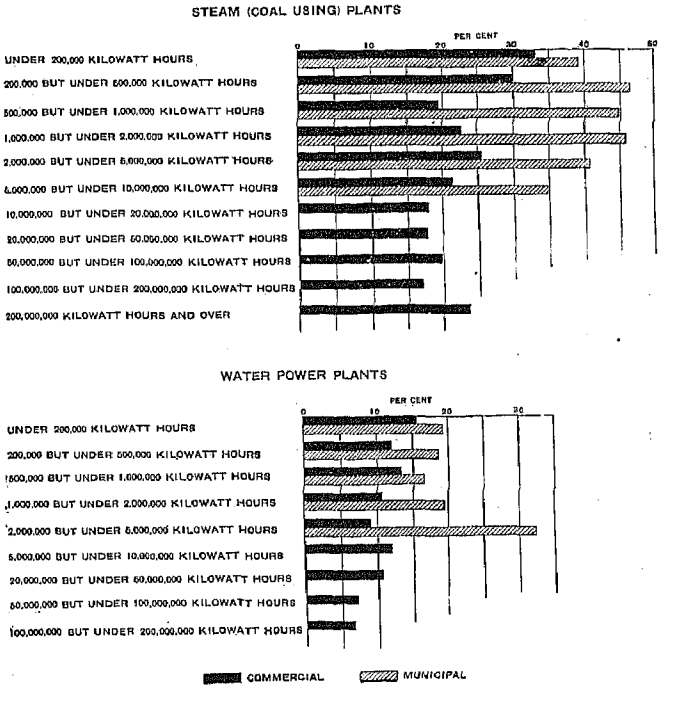


DIAGRAM 19.—TOTAL EXPENSES PER KILOWATT HOUR SOLD, BY KIND OF PRIMARY POWER USED, FOR COMMERCIAL AND MUNICIPAL STATIONS: 1917 (CENTS).

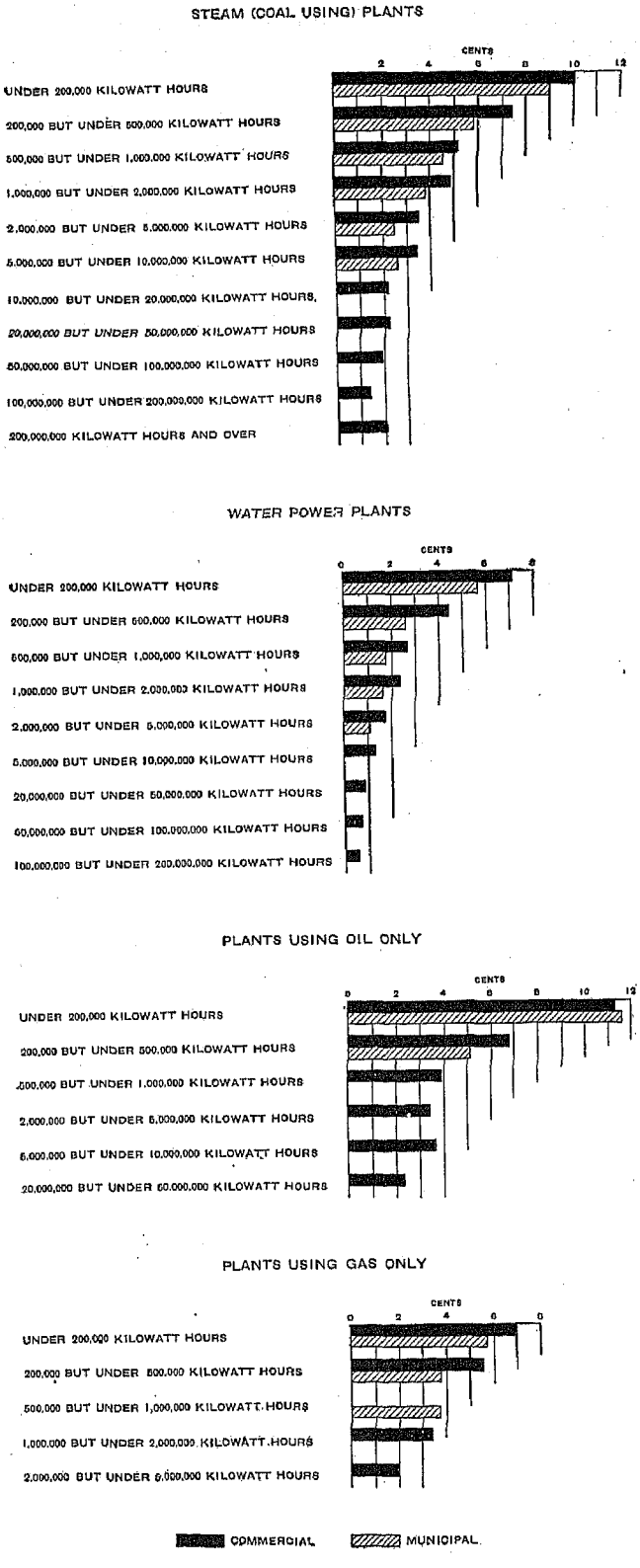


DIAGRAM 20.—NUMBER OF POUNDS OF COAL USED PER KILOWATT HOUR GENERATED, FOR COMMERCIAL AND MUNICIPAL STATIONS: 1917.

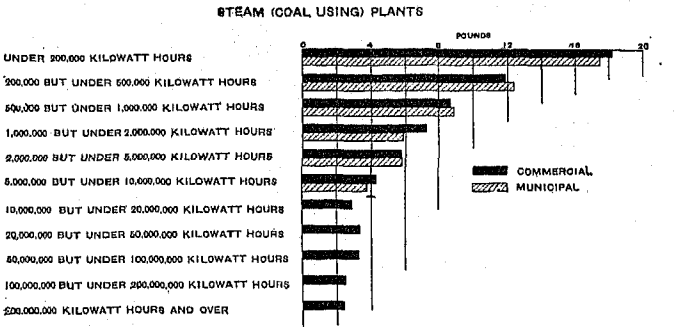
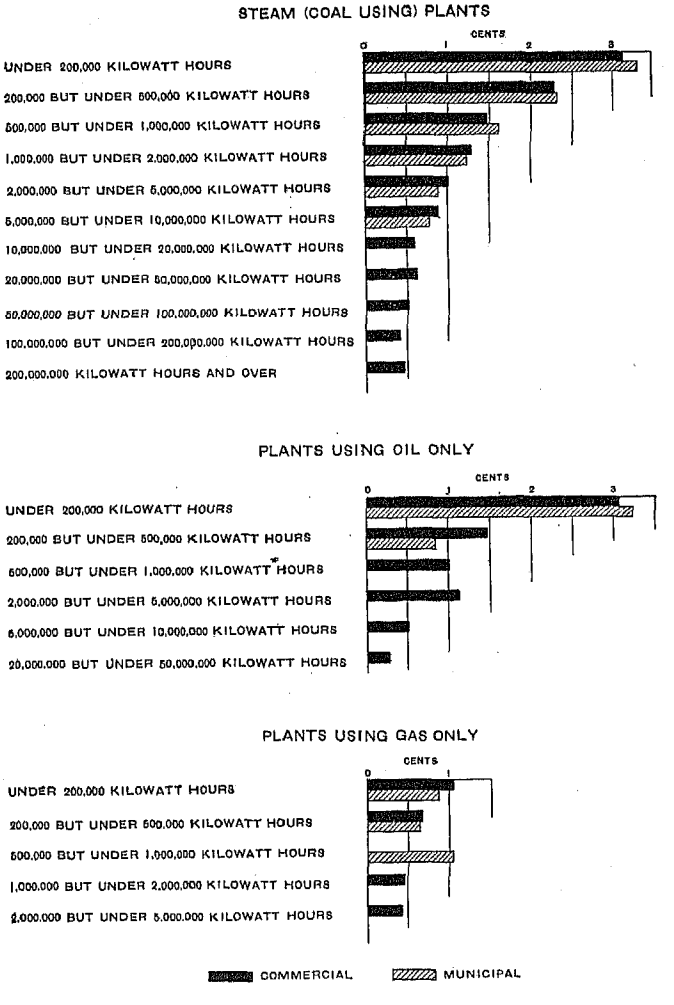


DIAGRAM 21.—COST OF FUEL PER KILOWATT HOUR GENERATED, BY KIND OF PRIMARY POWER USED, FOR COMMERCIAL AND MUNICIPAL STATIONS: 1917 (CENTS).



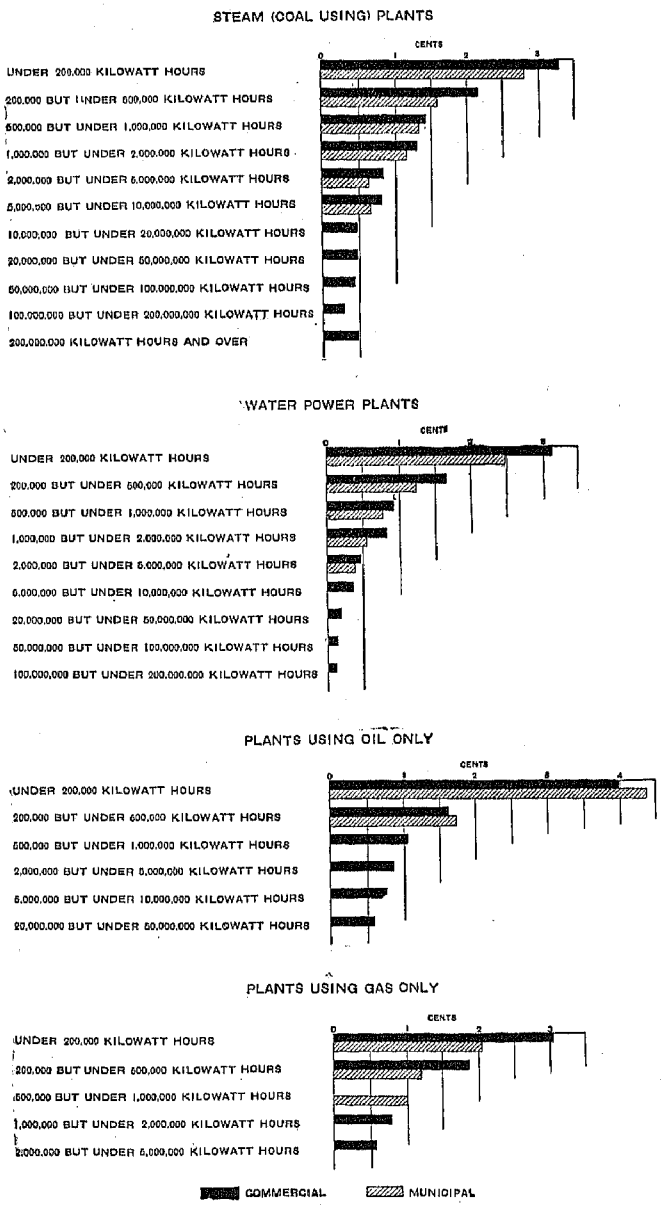
Except in the lowest group of oil-using plants, which is a numerous one, it is not possible to make comparisons between municipal and commercial stations. In this group, however, we find that the former pay considerably more per barrel for their oil than do the latter ($4.02 as opposed to $3.49). The quantity of oil consumed per kilowatt hour generated is about the same in either group. As the stations grow larger the price paid for oil decreases rapidly, as well as the quantity of oil which is required per kilowatt hour generated. However, on account of the small number of plants involved, it is not safe to make any positive deductions from the figures given.

In most groups of steam plants under the two classes of ownership the unit costs of coal are close together, but the percentage which the cost of fuel forms of the total outlays is always lower for commercial stations. For the oil plants in the group generating less than 200,000 kilowatt hours we find a somewhat higher rate paid for fuel per kilowatt hour sold by municipal plants. It should be noted, however, that there is a continuous decrease in the cost of coal per kilowatt hour generated as the output of electric stations is increased. While commercial stations generating under 200,000 kilowatt hours spend 3.103 cents per kilowatt for this purpose, the group generating over 200,000,000 kilowatt hours spends less than one-half of 1 cent for coal. The decrease in unit expenditure under this head, however, is not so marked after we have passed the group generating "10,000,000 but under 20,000,000 kilowatt hours."

What has been said regarding the decrease in the cost of fuel per kilowatt hour generated and sold is in the main true of the outlays for salaries and wages, which rank next in importance after fuel in the total expenses. This expense is naturally lower per kilowatt hour sold for water-power plants than for steam plants. It should, however, be observed that this expense is in nearly all cases higher per kilowatt hour sold for commercial than for municipal plants—a condition which is the result of several causes. First, municipal plants do not have salaried officers of corporations; secondly, somewhat lower wages are paid by municipal plants to their employees in general; and, third, many municipal plants secure part-time service from the employees of other public departments under circumstances which would make it necessary for a commercial plant to hire a full-time employee.

While miscellaneous expenses per kilowatt hour sold are higher for all municipal stations in the United States than for all commercial stations, they appear to be lower in practically every case for the municipal plants shown in Table 96. These so-called miscellaneous expenses include "electric current purchased," "rent of offices, stations, line-wire supports, conduits, etc.," "injuries and damages," and all other expenses incident to operation and maintenance which are not listed under the general heads given. It is also significant to find that the unit expenditure by municipal plants for insurance, while naturally a small item, is in nearly every instance much lower relatively than for commercial plants. In many cases this expense, if incurred, is taken care of by the general municipal budget.

DIAGRAM 22.—SALARIES AND WAGES PER KILOWATT HOUR SOLD, BY KIND OF PRIMARY POWER USED, FOR COMMERCIAL AND MUNICIPAL STATIONS: 1917 (CENTS).



Some taxes are paid by municipal plants, but, as indicated by the figures presented in Table 96, this charge is relatively negligible. For commercial sta-

tions it is apparent that the amount of taxes paid per kilowatt hour sold decreases as the plant increases in size, though there is little difference in the per cent which taxes form of the value of plant and equipment. The significant fact, however, is that, particularly in the case of coal-using and water-power plants, the relative importance of taxes in the total expenses continuously increased from the smallest to the largest plants. For coal-using plants this item constituted only 3 per cent of all expenses in the first group and 10 per cent in the group generating over 200,000,000 kilowatt hours.

DIAGRAM 23.—TAXES—PER CENT OF TOTAL EXPENSES IN COMMERCIAL COAL-USING AND WATER-POWER PLANTS: 1917.

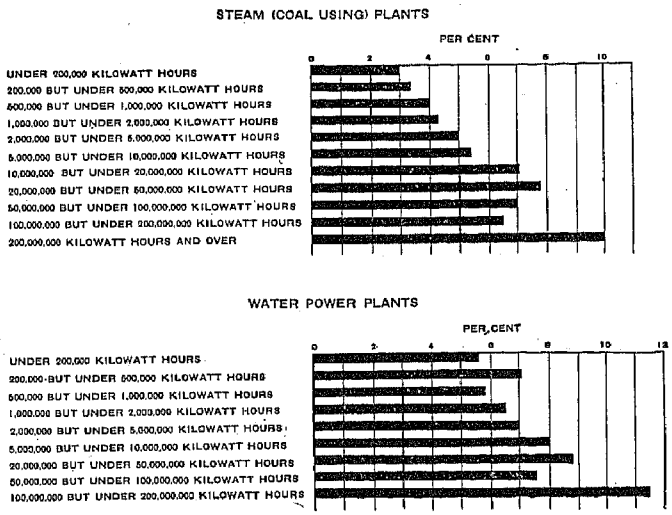


DIAGRAM 24.—DEPRECIATION PER KILOWATT HOUR SOLD, FOR COMMERCIAL AND MUNICIPAL STEAM AND WATER POWER PLANTS: 1917 (CENTS).

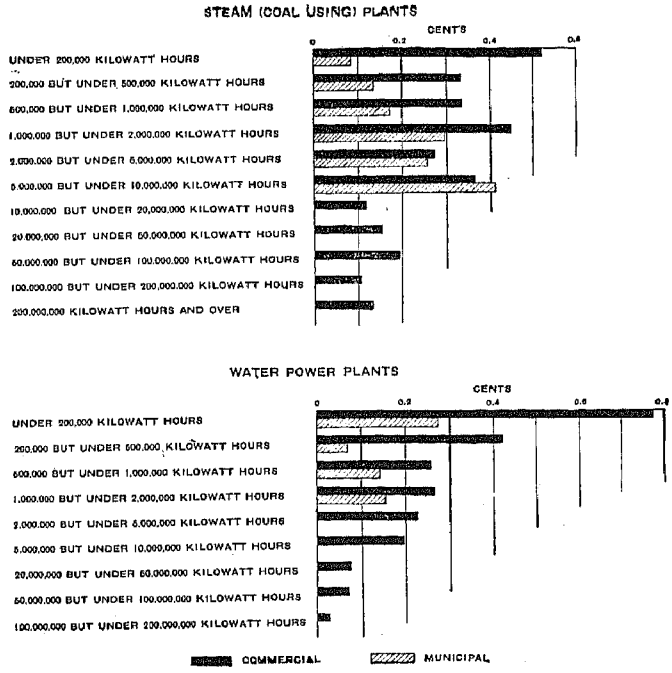
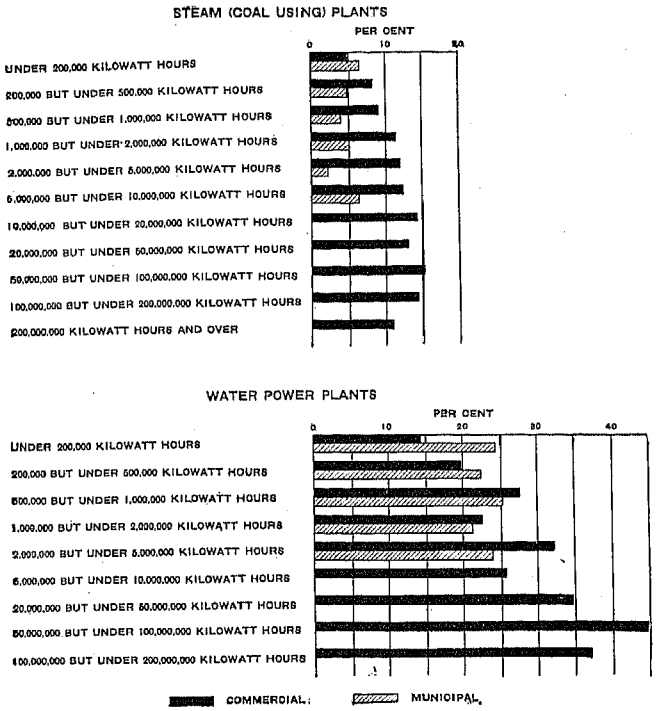


DIAGRAM 25.—PER CENT OF TOTAL EXPENSES PAID IN INTEREST BY COMMERCIAL AND MUNICIPAL PLANTS: 1917.

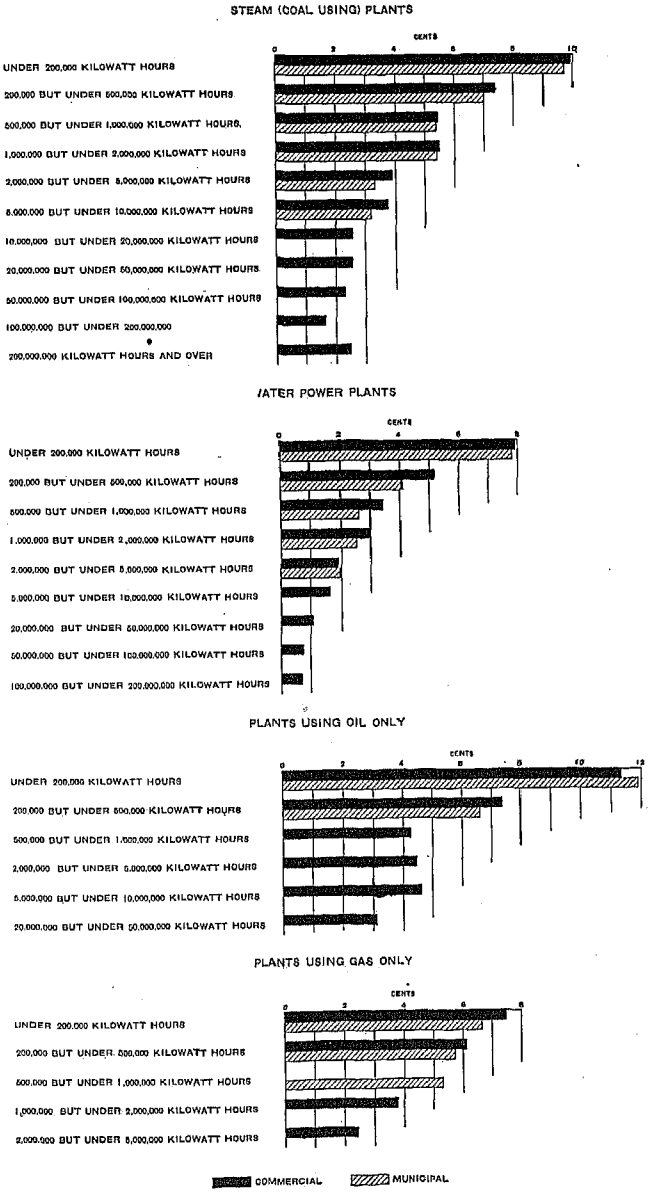


The amount expended for depreciation by municipal plants in the United States appears to be higher per kilowatt hour sold (about two-tenths of 1 cent) than that expended by commercial plants (one-tenth of 1 cent). The ratio of this expense to value of plant and equipment is also higher for the average municipal plant in the United States. However, upon examining the different groups of plants in Table 96, it appears that in most cases commercial plants are expending far more per kilowatt hour sold for depreciation than are municipal plants. Usually, also, this expense forms a larger proportion of the total for commercial than for municipal plants. The amount expended per kilowatt hour sold tends to grow less as plants increase in size, but the proportion which this charge forms of the total, as well as the percentage relation to the investment, does not appear to have any connection with the size of plant.

The last important item of expense is interest payments. It is found that in most cases commercial plants pay far more per kilowatt hour sold for interest than do municipal plants, and, further, that as a rule the percentage of the total expenses incurred under this head is also much higher for this group. Again, so far as commercial plants are concerned, there is a clearly marked tendency for the importance of this item to increase with the increase in the size of plant. Most significant, however, are the comparative figures, which show the relative importance of this item for commercial steam plants and commercial water-power plants. While in the case

of the former interest amounted to only 4.9 per cent of all expenses in the lowest group, in the corresponding group of water-power plants this charge amounted to 14.5 per cent. In the larger groups of coal-using plants the highest interest charge was only 15.2 per cent of the total expenses, whereas for the corresponding groups of water-power plants it amounted to 44.9 per cent of the total expenses. From these figures it is possible to draw a very definite conclusion regarding the need of sure guaranties for investment in hydroelectric stations and the significance of lower interest rates if there is to be a further development of our hydroelectric resources.

DIAGRAM 26.—TOTAL INCOME FROM SALE OF CURRENT, PER KILOWATT HOUR SOLD, IN COMMERCIAL AND MUNICIPAL STATIONS: 1917 (CENTS).



Perhaps attention should again be called specifically in this connection to some of those expenses incurred by commercial plants which are not incurred by municipal plants and which in most cases fully account for the difference existing between the unit costs for current sold. The most important item, of course, is taxes. To this should be added the higher charge for depreciation per kilowatt hour sold in these selected plants, as well as that portion of miscellaneous expenses which is due to advertising, display rooms, etc., together with that portion of salaries and wages which goes to salaried officers of corporations. When these deductions are made from the entire expenses, the first two of which are perfectly clear, it will be found that in most cases the unit costs are fully as low for commercial plants as for municipal, and frequently considerably lower. If an additional allowance were also made for the higher unit expenditure for interest paid by commercial plants, there is no question that most groups of commercial plants would be operating at a much lower cost per kilowatt hour than the corresponding municipal plants.

Income per kilowatt hour sold.—The differences in income per kilowatt hour sold by commercial and municipal plants are in most cases not so marked as the differences in the various operating expenses. It must be noted, however, that while there is usually very little difference in the average number of cents received per kilowatt hour sold for *all* purposes, it frequently happens in some of the higher groups that municipal plants charge considerably less for light than do commercial plants. The apparent advantage which the customers of municipal stations seem to have in this regard may, however, be misleading, for, as the schedules show, an unusually large percentage of the current supplied for light by the various groups of municipal plants is used for street lighting. The value of this service is usually merely estimated, frequently at a very low rate, and in all events the normal charge for street lighting is much lower than that for domestic lighting. Therefore, when the estimated value of street lighting is included with the income received from customers in general and the total is divided by the number of kilowatt hours reported as supplied for lighting purposes of all kinds, the resultant figure indicates an average lighting rate which is lower than actually exists. As the data are now collected, it is impossible to compare lighting rates except in a very general way.

In view of the fact that power rates for all plants are much lower for commercial than for municipal stations, it is somewhat surprising to find that in this particular selection of plants the average charge per kilowatt hour sold is about the same in most of the lowest groups. In several instances the rate appears to be even lower for municipal stations. But in many of these cases, it should be explained, a considerable part of the power used is supplied at an abnormally low rate for municipal uses. Customers in general are not so highly favored.

DIAGRAM 27.—INCOME FROM SALE OF CURRENT FOR POWER, PER KILOWATT HOUR SOLD, IN COMMERCIAL AND MUNICIPAL STEAM AND WATER POWER PLANTS: 1917 (CENTS).

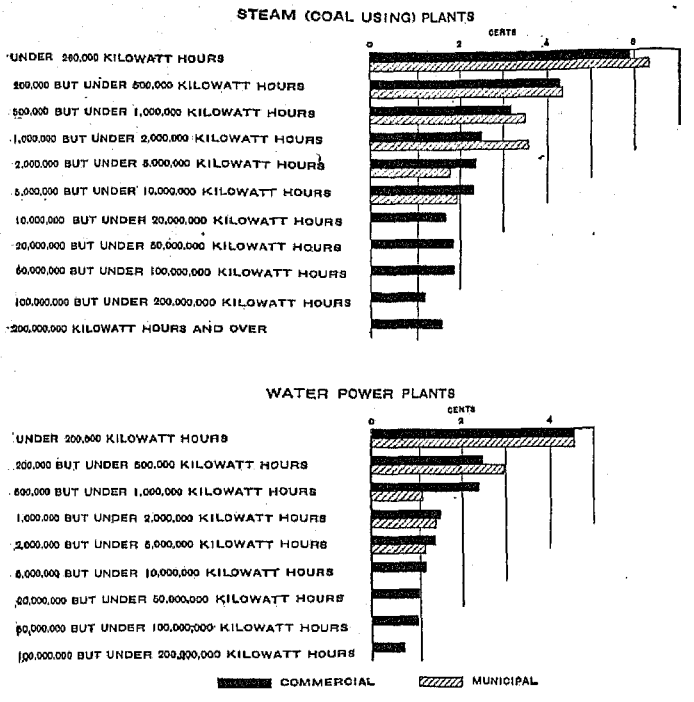
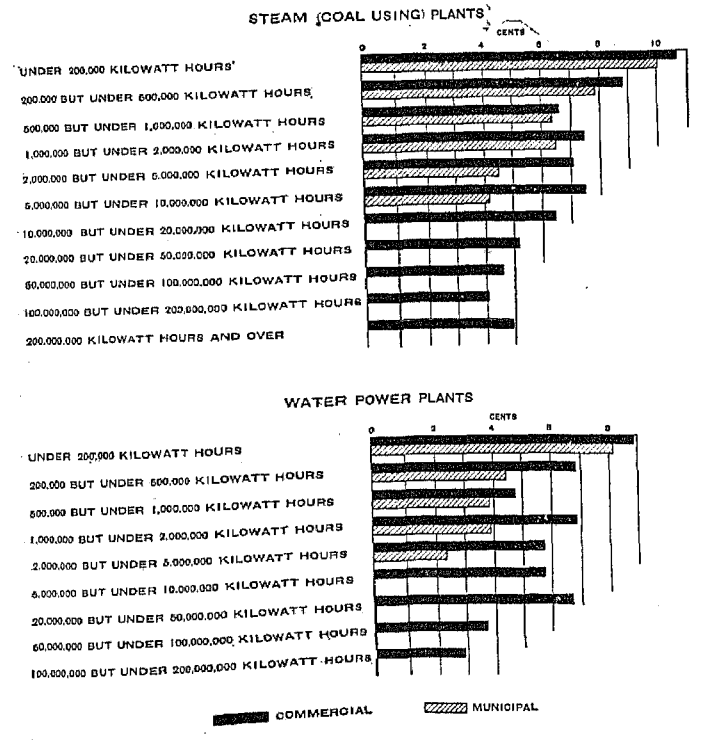


DIAGRAM 28.—INCOME FROM SALE OF CURRENT FOR LIGHT, PER KILOWATT HOUR SOLD, IN COMMERCIAL AND MUNICIPAL STEAM AND WATER POWER PLANTS: 1917 (CENTS).



So little current is sold by municipal plants to other companies, and so small an amount as well by the corresponding commercial plants, that no significant comparisons can be made. In general, rates charged for this service by the small commercial stations are somewhat higher than the rates charged by municipal plants. But, of course, the local situation is not known.

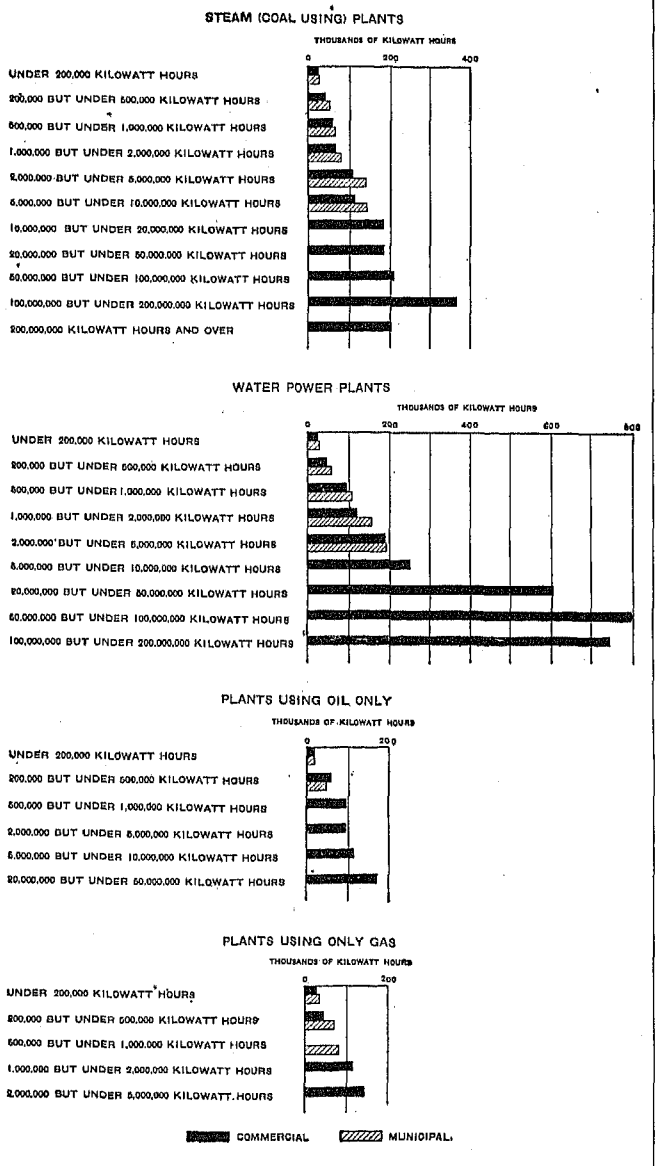
The average rates charged by oil-using plants are somewhat higher than those charged by steam plants and much in excess of the rates found in water-power plants.

In all classes there is a general tendency toward lower rates as the size of plant increases. This is particularly true of power rates, which for steam plants decrease from 5.903 cents in the lowest group to 1.163 cents in next to the highest group. An even more marked decrease is found in the case of water-power plants, which frequently sell a large proportion of their current to other companies and do a relatively small amount of lighting. On the other hand, after the first two groups are passed, there does not seem to be a very close connection between the average rates charged for lighting and the size of plants, except in the case of municipal stations, in which the rates appear to decrease. The net income per kilowatt hour sold, according to the figures here tabulated, is usually higher for municipal than for commercial plants. If, however, the former were subject to many of the additional charges necessarily incurred by the latter, this difference would no longer exist.

Employees.—Brief reference should be made to the labor efficiency of the various sizes and groups of stations in Table 96. The average number of employees is usually slightly lower for municipal than for commercial stations, due in the main to reasons which have already been suggested. As a result of this lower figure the average number of kilowatt hours sold per employee is normally somewhat higher for municipal stations. This means that in many cases the average income per employee is also higher, though for the entire United States both the output and the income are much higher in the case of commercial stations. As plants increase in size there is in almost every instance a corresponding increase in the number of kilowatt hours sold per employee, but in the case of coal-using plants this increase is not marked after the group generating "10,000,000 but under 20,000,000 kilowatt hours" has been reached. It is further significant that water-power plants, after the first two groups are passed, report a much higher number of kilowatt hours sold per employee than do any of the other classes of plants. Finally, there does not appear to be any particular connection between the average compensation paid to all employees and the size of plant, with the following exceptions: In the lowest group of coal-using plants and in the two lowest groups of water-power plants the average wage is lower than is normal in municipal stations,

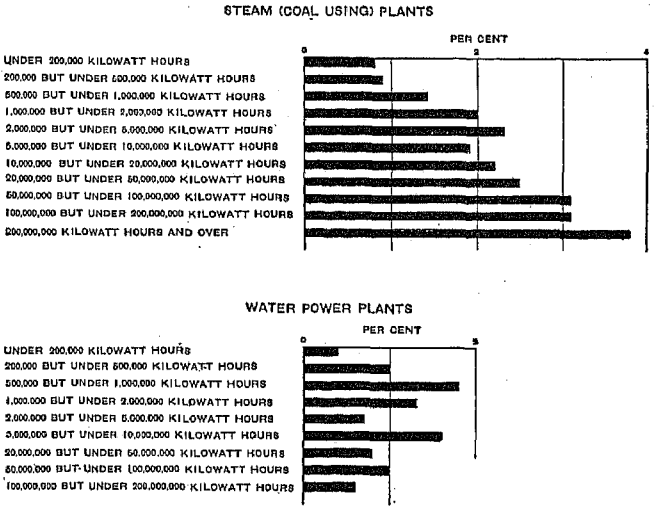
due, no doubt, to the fact that some of the workers reported are employed for only part of the time. In some of the highest groups of commercial plants, also, the average is found to be a little above the normal, probably because of the high compensation of salaried officers in these groups. Municipal coal-using plants in some cases appear to pay higher wages than do commercial plants. For the water-power plants, however, commercial stations always lead by a wide margin.

DIAGRAM 29.—KILOWATT HOURS SOLD PER EMPLOYEE, BY KIND OF PRIMARY POWER USED, FOR COMMERCIAL AND MUNICIPAL STATIONS: 1917.



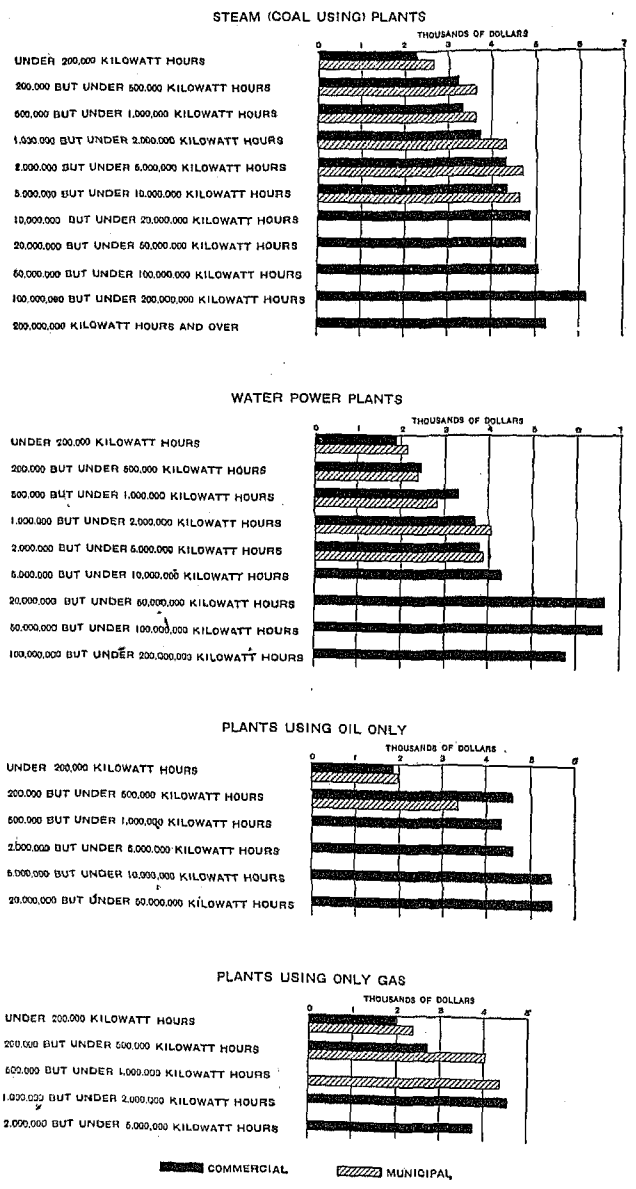
Dividends.—The amount paid in dividends per kilowatt hour sold bears no direct relation to the size of station, though for hydroelectric plants it appears to grow less as the stations become larger. In the case of coal-using plants the ratio which dividends bear to the value of plant and equipment is lowest in the first two groups, under 1 per cent. From this point, however, there is a constant upward tendency until the highest group is reached, when we find a rate of 3.8 per cent. Water-power plants, on the contrary, indicate no such tendency. Not only is the rate of dividend to total value lower for practically every group than for coal-using plants, but the general tendency seems to be toward a decreased rate as the size of plant increases. The highest rates paid are found in the group generating "500,000 but under 1,000,000 kilowatt hours" (1.8 per cent) and in the group generating "5,000,000 but under 10,000,000 kilowatt hours" (1.6 per cent). The highest groups pay a rate ranging from six-tenths of 1 per cent to 1 per cent. It does not, therefore, appear that at present hydroelectric stations are a particularly profitable investment.

DIAGRAM 30.—DIVIDENDS—PER CENT ON INVESTMENT FOR COMMERCIAL STEAM AND WATER POWER PLANTS: 1917.



Economies of large-scale production.—From the analyses which have already been made it is possible for the reader to deduce his own conclusions regarding the economies of large-scale production in the central electric light and power industry. The subject has been so presented in Table 96 and the accompanying diagrams that the conditions should be fairly obvious. A few remarks, however, may be in order regarding the facts indicated by the statistics of commercial plants, which alone furnish examples of real large-scale production.

IAGRAM 31.—AVERAGE INCOME PER EMPLOYEE, BY KIND OF PRIMARY POWER USED, FOR COMMERCIAL AND MUNICIPAL STATIONS: 1917.



So far as coal-using plants are concerned, we find a rapid decrease in most items of expense until the group is reached which generates "10,000,000 but under 20,000,000 kilowatt hours." After this point the tendency toward decreasing costs is by no means clearly marked, though it is most obvious in the case of fuel costs. In the groups of plants which are sufficiently large to be typical, however, the unit expense for salaries and wages does not show any appreciable decrease, nor is there much change in the items "supplies and materials," "insurance," "taxes," "depreciation," etc. It is further evident that, beginning with the group "10,000,000 but under 20,000,000 kilowatt hours" the value of plant and equipment per kilowatt capacity of dynamos remains fairly stationary, as well as the ratio of total income to total investment. The same facts appear in connection with the number of kilowatt hours sold per employee and the total income per employee.

In the highest group of coal-using plants, which generate "200,000,000 kilowatt hours and over," nearly all unit expenses mount rapidly. These are the plants which distribute current in very large cities, or, being located in a somewhat smaller place, furnish current to a large number of different municipalities. Tentatively, therefore, it would appear that conditions which such establishments have to meet are of such a nature that their increased economic efficiency over the moderate-sized plant is open to serious question. In the case of water-power plants it is also apparent that after the group which generates "20,000,000 but under 50,000,000 kilowatt hours" is reached the decrease in operating costs as the size of plant grows is not particularly marked. This, of course, may be due to the fact that current generated in these large hydroelectric stations is sent over increasingly long distances to the ultimate consumers.

Comparative statistics of plants purchasing all current.—After the analyses which have been made of the statistics of the selected group of generating plants, little need be said regarding the figures for plants which purchase all of their current. These were selected in the same manner as the others, all composite plants, unincorporated plants, plants doing only street lighting, and plants doing no commercial lighting being omitted from the tabulations. There are included, however, 571 commercial and 373 municipal stations, or 65.1 per cent and 68.9 per cent of the total number of purchasing plants reported under the respective forms of ownership. These also have been grouped according to the number of kilowatt hours purchased.

Upon comparing the expenses per kilowatt hour sold in the two groups of plants it appears that, in general, commercial stations are operating at a slightly lower cost, though the difference is in most cases by no means marked. Commercial stations usually pay the higher rate per kilowatt hour for salaries and wages, though they usually pay a considerably lower rate for current purchased than do municipal plants. Taxes, again, are an important item in the expenses of these commercial stations, while they also pay a much greater amount per kilowatt hour sold for depreciation. The percentage of the total expenses which is spent for depreciation is also higher for commercial stations, as well as the percentage which is paid for interest, except for the group "under 200,000 kilowatt hours."

The average rate of income from the sale of current is, as a rule, a little lower for commercial purchasing

plants than for municipal plants in the same group. As usual, however, the lighting rates charged by municipal plants average lower than the rates of commercial plants. Power rates of the former are normally higher except for the group "500,000 but under 1,000,000 kilowatt hours," while municipal plants in this group rarely sell current to other companies.

The number of employees per station frequently averages higher for commercial purchasing plants than for municipal, but the average wages paid by the former are usually higher. Again, the number of kilowatt hours sold per employee, because of the fewer number of employees, is in the main higher for municipal than for commercial plants. No definite comparisons, however, can be made between the average income per employee in the two groups.

The rate of dividends paid per kilowatt hour sold grows continuously lower as the size of purchasing plant increases, while the rate on the total investment tends to grow higher.

TABLE 97.—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—COMPARATIVE FINANCIAL AND OPERATING STATISTICS OF SELECTED STATIONS PURCHASING ALL CURRENT, GROUPED ACCORDING TO THE NUMBER OF KILOWATT HOURS PURCHASED: 1917.

GROUP.	Number of stations.	Average number of kilowatt hours purchased per station.	PERCENTAGE DISPOSAL OF CURRENT.				INCOME PER KILOWATT HOUR SOLD.						
			Light.	Power.	Other companies.	Losses in distribution, etc.	Total from all sources.[1]	Total from sales of current.[1]	Light.[1]	Power.[1]	Other companies.	All other income.	Net income.
United States:							*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
Commercial	877	1,225,251											
Municipal	541	299,678											
Under 200,000 kilowatt hours:													
Commercial	347	67,258	65.8	14.6	0.9	18.7	9.058	8.776	9.782	4.554	3.747	0.282	1.537
Municipal	322	50,251	71.2	10.5	1.2	17.1	8.867	8.732	9.348	4.707	5.801	0.135	1.747
200,000 but under 500,000 kilowatt hours:													
Commercial	96	327,080	53.4	24.1	2.5	20.0	6.774	6.532	8.031	3.618	2.601	0.242	1.208
Municipal	32	294,319	64.0	16.2	2.1	17.7	6.072	5.967	6.615	3.727	3.501	0.105	1.653
500,000 but under 1,000,000 kilowatt hours:													
Commercial	53	716,174	44.2	30.5	6.4	18.9	5.846	5.597	7.676	3.332	2.012	0.249	1.241
Municipal	12	682,983	70.2	13.5	.....	16.3	5.712	5.627	6.149	2.919	.....	0.085	1.636
1,000,000 but under 2,000,000 kilowatt hours:													
Commercial	24	1,424,207	35.4	37.9	8.6	18.0	4.371	4.271	7.062	2.197	1.963	0.096	0.671
Municipal	5	1,194,667	66.8	23.2	.....	10.0	4.994	4.931	5.693	2.734	.....	0.063	1.625
2,000,000 but under 5,000,000 kilowatt hours:													
Commercial	26	3,366,979	20.8	53.4	10.3	15.5	3.098	2.968	6.727	1.726	1.839	0.127	0.590
Municipal	2	2,761,000	46.9	43.7	.....	9.3	5.515	5.495	6.603	4.306	.....	0.017	0.693
5,000,000 but under 10,000,000 kilowatt hours:													
Commercial	9	8,118,339	19.7	55.0	13.1	12.2	3.153	3.001	7.782	1.653	1.482	0.152	0.581
10,000,000 but under 20,000,000 kilowatt hours:													
Commercial	8	15,274,251	22.7	54.8	12.1	10.4	1.771	1.705	3.119	1.191	1.521	0.047	0.166
20,000,000 but under 50,000,000 kilowatt hours:													
Commercial	5	27,874,303	22.0	53.0	13.3	11.7	2.578	2.518	5.800	1.644	0.596	0.058	0.417
50,000,000 but under 100,000,000 kilowatt hours:													
Commercial	3	61,701,857	0.3	43.6	50.1	6.0	0.547	0.536	8.830	0.476	0.536	0.011	0.043

GROUP.	EXPENSES.											
	Total per kilowatt hour sold.	Supplies and materials per kilowatt hour sold.	Salaries and wages.		Electric current purchased.			Miscellaneous expenses per kilowatt hour sold.	Insurance per kilowatt hour sold.	Taxes.		
			Per kilowatt hour sold.	Per cent of total expenses.	Cost per kilowatt hour purchased.	Cost per kilowatt hour sold.	Per cent of total expenses.			Per kilowatt hour sold.	Per cent of total expenses.	Per cent of investment.
Under 200,000 kilowatt hours:	*Cents.*	*Cents.*	*Cents.*		*Cents.*	*Cents.*		*Cents.*	*Cents.*	*Cents.*		
Commercial	7.521	0.594	1.595	21.2	2.932	3.606	47.9	0.465	0.070	0.256	3.4	0.8
Municipal	7.120	0.781	0.977	13.7	3.655	4.408	61.9	0.145	0.024	0.002	.....	.....
200,000 but under 500,000 kilowatt hours:												
Commercial	5.566	0.392	1.256	22.6	1.909	2.386	42.9	0.454	0.053	0.244	4.4	1.1
Municipal	4.419	0.517	0.882	20.0	2.041	2.480	56.1	0.142	0.026	0.002	.....	.....
500,000 but under 1,000,000 kilowatt hours:												
Commercial	4.695	0.267	0.954	20.7	1.566	1.931	41.9	0.396	0.054	0.228	5.0	1.1
Municipal	4.076	0.462	0.778	19.1	1.805	2.156	52.9	0.193	0.052	0.050	1.2	0.7
1,000,000 but under 2,000,000 kilowatt hours:												
Commercial	3.700	0.240	0.680	18.4	1.343	1.638	44.2	0.251	0.039	0.162	4.4	0.9
Municipal	3.368	0.163	0.571	17.0	1.898	2.107	62.6	0.060	0.035	.....	.....	.....
2,000,000 but under 5,000,000 kilowatt hours:												
Commercial	2.508	0.129	0.362	14.4	1.049	1.241	49.5	0.228	0.018	0.118	4.7	0.9
Municipal	4.821	2.216	1.372	28.4	1.022	1.008	23.4	0.027	.....	.....	.....	.....
5,000,000 but under 10,000,000 kilowatt hours:												
Commercial	2.572	0.100	0.480	18.7	1.098	1.251	48.6	0.180	0.026	0.172	6.7	2.3
10,000,000 but under 20,000,000 kilowatt hours:												
Commercial	1.605	0.047	0.196	12.2	0.851	0.950	59.2	0.076	0.009	0.086	5.4	1.3
20,000,000 but under 50,000,000 kilowatt hours:												
Commercial	2.161	0.091	0.297	13.8	1.078	1.221	56.5	0.180	0.016	0.099	4.6	1.4
50,000,000 but under 100,000,000 kilowatt hours:												
Commercial	0.504	0.010	0.027	5.3	0.245	0.261	51.7	0.022	0.003	0.017	3.3	0.8

[1] Includes estimated value of free service.

TABLE 97.—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—COMPARATIVE FINANCIAL AND OPERATING STATISTICS OF SELECTED STATIONS PURCHASING ALL CURRENT, GROUPED ACCORDING TO THE NUMBER OF KILOWATT HOURS PURCHASED: 1917—Continued.

GROUP.	EXPENSES—continued.					DIVIDENDS.		VALUE OF PLANT AND EQUIPMENT.		EMPLOYEES.			
	Depreciation.			Interest.									
	Per kilowatt hour sold.	Per cent of total expenses.	Per cent of investment.	Per kilowatt hour sold.	Per cent of total expenses.	Per kilowatt hour sold.	Per cent of investment.	Per kilowatt hour sold.	Total income—Per cent of investment.	Number per station.	Average compensation.	Kilowatt hours sold per employee.	Total income per employee.
United States:	*Cents.*			*Cents.*		*Cents.*		*Cents.*			*Dollars.*		*Dollars.*
Commercial									30.0	5.0			5,798
Municipal									27.9	2.7			4,326
Under 200,000 kilowatt hours:													
Commercial	0.558	7.4	1.8	0.376	5.0	0.503	1.6	30.6	29.6	1.8	493	30,900	2,799
Municipal	0.113	1.6	0.5	0.669	9.4			22.2	30.9	1.0	400	40,905	3,627
200,000 but under 500,000 kilowatt hours:													
Commercial	0.373	6.7	1.6	0.407	7.3	0.416	1.8	22.9	29.6	4.1	801	63,759	4,310
Municipal	0.170	3.9	1.4	0.199	4.5			11.8	51.4	2.7	786	89,106	5,410
500,000 but under 1,000,000 kilowatt hours:													
Commercial	0.393	8.5	2.0	0.380	8.3	0.464	2.3	20.1	20.1	6.6	834	87,407	5,110
Municipal	0.294	7.2	4.2	0.081	2.0			7.0	81.6	6.1	731	93,997	5,369
1,000,000 but under 2,000,000 kilowatt hours:													
Commercial	0.342	9.2	2.0	0.348	9.4	0.397	2.3	17.4	25.2	10.1	784	115,328	5,042
Municipal	0.288	8.6	4.3	0.144	4.3			6.7	75.0	6.4	960	168,068	8,393
2,000,000 but under 5,000,000 kilowatt hours:													
Commercial	0.157	6.2	1.1	0.255	10.2	0.299	2.2	13.7	22.5	13.0	785	217,023	6,724
Municipal	0.076	1.6	0.5	0.003	0.1			14.1	39.2	25.0	1,374	100,125	5,522
5,000,000 but under 10,000,000 kilowatt hours:													
Commercial	0.185	7.2	2.5	0.178	6.9	0.252	3.4	7.5	41.9	38.2	896	186,444	5,879
10,000,000 but under 20,000,000 kilowatt hours:													
Commercial	0.069	4.3	1.1	0.173	10.7	0.153	2.3	6.5	27.3	31.0	866	441,536	7,818
20,000,000 but under 50,000,000 kilowatt hours:													
Commercial	0.162	7.5	2.3	0.124	5.8	0.194	2.7	7.0	30.6	99.0	742	249,693	6,438
50,000,000 but under 100,000,000 kilowatt hours:													
Commercial	0.089	17.6	4.4	0.077	15.2			2.0	27.1	17.3	892	3,345,058	18,302

DIAGRAM 32.—TOTAL EXPENSES, PER KILOWATT HOUR SOLD, FOR COMMERCIAL AND MUNICIPAL STATIONS PURCHASING ALL CURRENT: 1917 (CENTS).

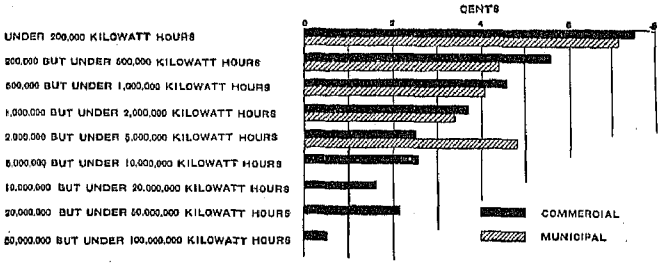
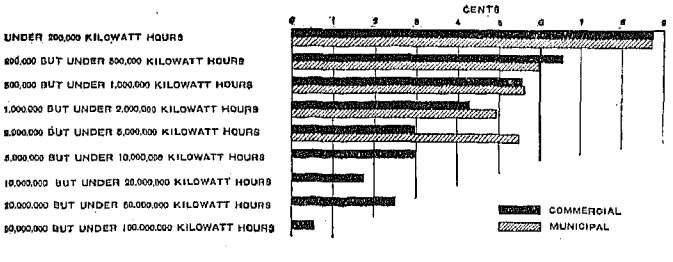


DIAGRAM 33.—TOTAL INCOME FROM SALE OF CURRENT, PER KILOWATT HOUR SOLD, FOR COMMERCIAL AND MUNICIPAL STATIONS PURCHASING ALL CURRENT: 1917 (CENTS).



In the matter of investment it is found that municipal plants nearly always have a much lower investment per kilowatt hour sold than do commercial plants. Further, the economies in investment which result from an increase in size of purchasing plants are remarkably obvious. Whereas commercial stations in the lowest group report an average investment of 30.6 cents per kilowatt hour sold, those in the higher groups report an investment of only about 7 cents per kilowatt hour sold, and in the highest group, which is not typical, as little lighting service is rendered, the average is only 2 cents per kilowatt hour sold. In the ratio of total income to investment, municipal plants, as usual, have the advantage; nor is it apparent that any particular changes in this relation arise as the size of plant is increased.

Finally, mention should be made of the apparent economies which arise in connection with large purchasing stations. In this group of commercial plants we find a constantly decreasing expense per kilowatt hour sold until the group is reached which purchases "10,000,000 but under 20,000,000 kilowatt hours." After this point it is difficult to draw conclusions, inasmuch as the next two groups have very few plants. The highest group, purchasing "50,000,000 but under 100,000,000 kilowatt hours," is not typical, and in next to the highest group most items of expense are greater per kilowatt hour sold than in the group purchasing less than 20,000,000 kilowatt hours. The fact that this same group seemed to mark a halting point in the case of steam-generating plants suggests possible problems which it is not within the function of the Census Bureau to solve.